

Flammable mists from accidental hydrocarbon releases offshore

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The report investigates offshore hydrocarbon releases in an attempt to identify whether mists of hydrocarbon droplets were formed, and if these presented a flammability hazard. Scientific literature has been searched for the present state of knowledge of the physics of two-phase mist generation. An empirical correlation has been used to model the reported hydrocarbon releases for a five year period and estimate whether flammable mists could have been generated.

It was found that ninety-five percent of reported liquid releases (forty-five percent of total reported releases) could have formed flammable mists. It was also noted that there were thirty-five cases of high flash point diesel and machine oils igniting as flash fires in five years.

Having established that flammable mists are being generated, the state of computational modelling and its validity has been reviewed to identify whether industry is able to characterise this risk in order to enact measures to control it. This found that computer programs existed to model both mechanical and flashing mist generation although the ability of these programs to model subsequent dispersion and rainout was limited. Validation studies of jet breakup are continuing but are focused on characterisation of single component flashing releases, not mechanical breakup of multiple component mixtures.

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EXECUTIVE SUMMARY

Objectives

- Examine the OSD hydrocarbon release database and attempt to determine the number of incidents that may have generated two-phase mists.
- Identify any relevant models and assess their range of validity.
- Review literature for experimental trials suitable as validation studies for the identified models.
- Assess whether flammable risks from two-phase mists are being identified, analysed and reduced to ALARP.
- Identify if any areas require further validation.

Main Findings

- The combustion behaviour of fuel mists have been summarised and the burning properties of droplets sizes less than 30 µm have been highlighted as particularly hazardous.
- Between April 2000 and December 2005, there have been thirty-five flash-fires of non-process diesel and oils and three flash-fires of process hydrocarbons.
- Of ignited releases, 78 % of non-jet fires occurred as explosions or flash-fires rather than pool fires demonstrating that realistic release conditions favour significant airborne dispersion over rainout.
- An analysis of ignited and un-ignited releases found that 45% (96% of liquid releases) occurred under conditions that could have formed droplets within the flammable size range.
- Demonstration has been made that industry is aware of the current lack of knowledge of aerosol generation and steps are being taken to resolve this but the focus remains on single component, superheated gases rather than multi-component process fluids and high flashpoint hydrocarbons.

Recommendations

- Awareness of the potential hazards associated with high flashpoint fuels needs to be raised within the process safety industry. Pressurised hydrocarbon fluids need to be considered during risk assessments.
- Consider revision of OIR12 form to include the presence of mist, area of pool/rainout and more details of the released hydrocarbon, e.g. Product datasheet for non-process hydrocarbons and compositions for process hydrocarbons.
- Experimental work is required to validate droplet size correlations against realistic release scenarios (high flashpoint hydrocarbons and multi-component process fluids) instead of single phase pressurised gases and atypical polar fluids.
- Further experimental work is needed to understand the mechanisms of accelerated flame propagation and associated higher overpressures within preheated optically thick fuel mixtures.

1 INTRODUCTION

Off shore oil and gas installations store and process very large inventories of different hydrocarbon mixtures. The crude oil/natural gas is pumped from the seabed and separated by distillation at different pressures and temperatures. Therefore the installations need to heat and pressurise the crude, which requires further non-process hydrocarbons for fuel and to act as lubrication and heat transfer fluids.

An accidental release of any of these fluids is hazardous because of their inherent flammability. Gaseous and two-phase releases will have at least some flash fraction that will disperse through the installation and if ignited can form either a flash-fire or, depending on the degree of congestion, a vapour cloud explosion. Higher flashpoint fluids, such as lubrication oils, may form pool fires or, if atomised, flash-fires or explosions. In addition, all hydrocarbons may flash back to the source and form a jet fire.

Any of these hazards can damage plant work around the release and lead to a domino effect. Because of the inherent financial restraints of operating offshore, the cost increases with the size of the installation and the distance between equipment is kept to a minimum, as is the distance between plant work and occupied buildings.

The nature of the off shore gas and oil industry requires the facilities to be geographically isolated and requires the workforce to remain within the vicinity of the plant work.

For all these reasons, hydrocarbon releases are closely monitored by HSE Off Shore Division who maintain a database of all reported releases since 1993 for the use of estimating failure rates and identifying trends.

2 DEFLAGRATION OF FLAMMABLE MISTS/AEROSOLS

For the purpose of this report the term mist shall be used to refer to droplets of liquid of any size suspended in air. It has been previously thought that the highest flame speeds were produced by stoichiometric vapour/air mixtures and as the droplet diameter increases the flame speeds decrease due to the droplet vaporization energy. However, mathematical and experimental studies into flame front progression through a flammable mist have shown that this may not be the case.

Mists with droplet sizes of 7 μm or less evaporate ahead of the flame front due to heat and pressure and so burn as vapour clouds. In mists with droplet sizes above 30 μm , the flame front spreads more slowly, burning the vapour in envelopes around each droplet. The flame speed decreases with increasing droplet size as more heat is drained from the reaction front. However, mists with droplets within the range 7 – 30 μm have been theorised to burn with a significantly greater burning velocity, generating higher overpressures. In experimental investigation of tetralin mists, the flame has been seen to visually change from a pre-mixed gas burner flame to a spray of burning droplets at a droplet size of approximately 10 μm . (1) (2) (3)

Bowen and Cameron have undertaken a review of work in this area in 1999, but they concluded that there had not been sufficient experimental work to characterise mists with sufficient confidence. (4) (5)

Small droplets are also more easily entrained into air streams and remain airborne for longer, generating larger flammable mist clouds. It is for this reason that characterising droplet diameter and distribution is important for offshore risk assessment.

3 PROPERTIES OF FLAMMABLE FLUIDS OFFSHORE

There are three mechanisms by which a flammable mist might be generated from an accidental release.

3.1 PRESSURE LIQUEFIED GASES

When a fluid stored above its boiling point is released, it flash boils creating bubbles of vapour within the jet stream. These coalesce until they shatter the jet into a distribution of droplets. Depending on a number of factors including the fluid boiling point and entrainment of air into the jet, these droplets may evaporate, pool on the ground or be carried along with the air stream forming a mist.

The resulting droplet diameters will continually decrease as they evaporate. Should the jet path impinge on a solid surface, the droplets will condense and generate a pool that will begin to evaporate. Allen has undertaken experimental investigation of impinging jets. (6)

Witlox and Bowen have reviewed the current understanding of flashing liquid jets in a contract research report for HSE in 2002. (7) (8)

3.2 FLAMMABLE LIQUIDS UNDER PRESSURE

Fluids stored below their boiling point can also form mists under certain release conditions. If a liquid jet is released with enough velocity it will break up into droplets due to resistance with the air. When the aerodynamic shear is greater than the liquid cohesion, the jet will break apart into droplets that may be small enough to be carried along in the air stream and form a mist.

Very little work has been done into predicting the hazards from these types of releases. The widely accepted view in industry is that only large droplets are formed, which rain out and form a liquid pool. Most experimental work on high flashpoint liquids has been done in the area of diesel injectors and has not been applied to hazard studies.

3.3 MULTICOMPONENT FLUIDS

Crude oil is not a pure chemical but a mixture of different hydrocarbon fractions. Even after the crude is processed through a separator, some lighter fractions remain in solution. Under a pressurised release, the components with lower boiling points will flash, breaking up the jet of the heavier components. This more complex situation is the best characterisation of a release of pressurised crude oil.

3.4 TWO-PHASE FLUIDS

The source fluids may also be in two-phases before being released in which case they are either miscible or immiscible. If miscible, the liquid phase will be supersaturated with the vapour phase and upon release, the pressure drop will drive the vapour out of the liquid, causing a situation analogous to flashing break-up. If immiscible the vapour phase will not be dissolved in the liquid phase but will add to the mechanical pressure driving it out of the orifice and breaking up the jet as in the case of the pressurised liquids.

4 INCIDENT DATA

A recent report by HSL involved an audit of a typical offshore platform to identify potential ignition sources. An inventory of flammable materials and their storage conditions has been reproduced in table 1. (9)

Table 1 – Inventory of typical offshore platform

Location	Material	Phase	Approximate Volume (liquid) m ³	Approximate Volume (gas) m ³	Temperature °C	Pressure bar
HP Separator	Oil & Gas	2-Phase	66	110	95	24
LP Separator	Oil & Gas	2-Phase	79	132	65	16
HP Gas Cooler	Gas	Gas		14	95	
HP Compressor Aftercooler	Gas			30		150
Wet Gas glycol contractor	Gas	Gas		24		0.01
Chilled Gas Separator	Gas	Pressure Liquefied Gas	4	14		
Gas Compressors	Lubrication Oil	Pressurised Liquid			40	80
	Seal Oil	Pressurised Liquid			40	80
Oil Line	Spiked Crude	Multi-Component Multi-Phase	7		60	130
Helifuel tank	Jet A1		30		Ambient	1
Day Storage tank	Diesel		24		Ambient	1

Even measured as a static capacity, large volumes of hydrocarbon fractions are processed as either multi-phase or pressurised fluids with the potential to generate a flammable mist upon release.

Under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR), and prior offshore legislation, all accidental releases of hydrocarbons have been reported to HSE. OSD keep a database of offshore release statistics, which are available to industry to aid in the preparation of offshore safety cases. This database of reported releases has been used to investigate the number of hydrocarbon releases that may have potentially formed flammable mists.

The hydrocarbon release database categorises releases into 5 chemical states. These are ‘oil’, ‘gas’, ‘condensate’, ‘2-phase’ and ‘non-process’. Petroleum ‘gas’ may form mists or pools upon release before reaching thermal equilibrium and a number of correlations have been proposed to model this. These have been reviewed by Witlox et al as described above. However, due to the difficulty in defining post expansion parameters, mathematical correlations have not been applied to these releases.

‘2-phase’ releases can clearly form flammable mists and have been included as potential sources without further investigation. Although these releases may evaporate upon release, the relatively low number of 2-phase releases per year (circa 14) was not thought to skew the results.

‘Oil’, ‘condensate’ and ‘non-process’ are liquids at ambient temperature and pressure but, stored under pressure, may break-up into mists upon release. A correlation defined by Bowen and Shirvill has been used to characterise whether a mist will form with droplet sizes within the flammable range. **(10) (11)**

Depending upon the release conditions of the liquid, several regimes of jet break-up may be predicted. Low-pressure releases of fluids with high surface tensions break-up in a ‘drip’ or ‘rayleigh’ regime where the resulting droplets are larger than the orifice diameter. ‘Wind-induced’ break-up due to aerodynamic forces produce droplets within an order of magnitude of the orifice while at higher pressure, the ‘atomisation’ regime produces a very fine spray of tiny droplets. **(12)**

For the purpose of classifying a hazardous mist only the ‘atomisation’ regime is likely to produce a mist of 30 µm droplets or smaller however, ‘2nd wind-induced’ jets may form mists that are flammable and since a range of droplet sizes will be generated, the boundary between large and small ‘wind-induced’ regimes has been chosen as the definition of a flammable mist. This threshold is written in equation (1).

$$Ca = 17.8.Z^{0.91} \quad (1)$$

Where $Ca = \frac{\mu_L U}{\sigma_L}$ and $Z = \frac{\mu_L}{\sqrt{(\sigma_L \rho_L d_o)}}$

μ_L = Viscosity (kgm⁻¹s⁻¹)

U = Jet velocity at orifice (ms⁻¹)

σ_L = Surface tension of the liquid (Nm⁻¹)

ρ_L = Density of the liquid (kgm³)

d_o = Diameter of the orifice (mm)

Above this limit, the jet breaks up according to the ‘2nd wind-induced’ regime and is considered potentially flammable. Beneath the limit the droplets are predicted to be of the order of 100 µm or larger. Droplets of this magnitude are thought to be non-flammable due to the heat lost to vaporise the liquid, and are expected to quickly rain out.

Unfortunately, the equation cannot deal with multi-component mixtures so the categories must be modelled as pure liquids. The densities of the hydrocarbon fractions are specified in the database but because of the complex nature of petroleum crude oil, surface tension and viscosity values are not known. For this reason data has been taken from a paper by George et al. Values for the viscosity and surface tension at 95 °C have been estimated based on lower temperature measurements of a crude oil sample with an API of 31.52. **(13)**

No comparative paper has been found for natural gas condensate but material safety data sheets indicate that up to 95% of the composition is hexane. Therefore the values for n-hexane have been used as a single component substitute. ‘Non-process’ releases where no data or substitutes can be identified, e.g. oil-based mud, have been omitted from the review. **(14)**

Table 2 – Review of reported releases

Flammable mist formed	Year	Category						Total
		2 Phase	Condensate	Gas	Non-Process	Oil	Sub-Total	
Yes	2000-2001	22	9	0	30	49	110	663
	2001-2002	21	17	0	27	53	118	
	2002-2003	12	17	0	22	50	101	
	2003-2004	8	21	0	29	76	134	
	2004-2005	6	13	0	40	54	113	
	2005-2006	15	12	0	20	40	87	
No	2000-2001	0	3	141	4	9	157	801
	2001-2002	0	0	117	0	0	117	
	2002-2003	0	0	125	1	0	126	
	2003-2004	0	0	131	0	0	131	
	2004-2005	0	0	148	1	0	149	
	2005-2006	0	1	111	3	6	121	
Total		84	93	773	177	337	1464	1464

Approximately fifty five percent of all offshore hydrocarbon releases are gas (773 of 1464), but of the forty five percent that are fluids, this equation predicts over ninety five percent of them could have formed a potentially flammable mist (663 of 691).

The vast majority of these will be formed with large mean droplet sizes that will quickly precipitate out and form a spreading pool. However, in each case a distribution of droplet sizes will be formed and the smaller fractions will spread further as a flammable mist.

The records of ignited releases demonstrate the issue further. Although very few ignited releases are reported each year, the statistics indicate that the vast majority of ignitions are from non-process liquids.

Table 3 – Review of reported fires

Flammable mist formed	Year	Category					Sub-Total	Total
		2 Phase	Condensate	Gas	Non-Process	Oil		
Yes	2000-2001	0	0	0	8	0	8	51
	2001-2002	0	1	0	8	0	9	
	2002-2003	0	1	0	2	2	5	
	2003-2004	0	1	0	8	1	10	
	2004-2005	0	0	0	13	0	13	
	2005-2006	0	0	0	6	0	6	
No	2000-2001	0	0	4	0	1	5	20
	2001-2002	0	0	2	0	0	2	
	2002-2003	0	0	1	1	0	2	
	2003-2004	0	0	3	0	0	3	
	2004-2005	0	0	3	1	0	4	
	2005-2006	0	0	3	1	0	4	
Total		0	3	16	48	4	71	71

These are mostly high flashpoint machine oils that should not ignite as *pool fires* without considerable heating. In fact the majority of the high flash point oil releases that do ignite are recorded to form a flash-fire, demonstrating that some form of flammable mist is present. Considering the flash points of these fluids in their liquid forms, it is concluded that they form mechanically generated mists.

Table 4 – Review of reported types of fire

Category	Type of fire reported			
	Flash	Explosion	Jet	Pool
Bottled gas	1	1	1	0
Diesel	11	0	3	1
Heat transfer oil	1	0	0	2
Hydraulic oil	3	0	0	0
Lub oil	20	0	0	8
Process fluids	12	5	8	5
Total	48	6	12	16

This demonstrates that in the last 5½ years, 48 releases have formed flash-fires, of which 35 (48 - 12 process fluids - 1 bottle gas) were ‘non-process’ oil and diesel releases. These could not have vaporised and must have been dispersed as mists.

5 PREDICTIVE MODELS

The Offshore Installations (Safety Case) Regulations 2005 (SCR05) require operators and owners to submit safety cases for their installations. HSE assesses each case to decide if a case for safety has been made. Because of the high potential of hazards combined with the difficulty of escape, the burden is upon industry to demonstrate that they have reduced risk to ALARP.

Most offshore safety cases rely on predictive computer models to evaluate the hazards from accidental releases. A few sophisticated programmes dominate the field.

- PHAST
- SHELL Sheppard
- EJECT
- RELEASE
- Dunbar
- TNO
- SuperChems

5.1 PHAST

One such model is PHAST developed by DNV Technica. It is a modular programme that simulates releases by breaking the process down into stages. Each module feeds its output into the source terms for the next stage. The stage that simulates the formation of a mist is called the ‘flash-model’ and its outputs (droplet size, temperature, etc) are input into a ‘unified dispersion model’, UDM.

The ‘flash model’ relies upon a series of assumptions about the physics of expansion. Depending on the release conditions, two mechanisms of droplet formation are possible. The mechanism that produces the smallest droplet size is assumed to dominate, either ‘mechanical’ or ‘flashing’.

Mechanical break up modelling relies upon a critical Weber number to predict the largest stable droplet diameter within the resultant jet stream. This has been investigated by experimentation and found to lie within a range of 10-22. **(15) (16) (17)**

$$We_{Crit} = \rho_a u_o^2 d_p / \sigma_L = 10 - 22$$

Where ρ_a = Atmospheric density (kgm^{-3})

u_o^2 = Square of velocity at orifice (m^2s^{-2})

d_p = Diameter of droplet (m)

σ_L = Surface tension of liquid (Nm^{-1})

The following correlation is used for flashing break-up based on the partial expansion energy, E_p .

$$D_d = (0.833 * 10^{-3}) - 0.73 * 10^{-3} \ln(E_p)$$

Where D_d = Diameter of droplet

For stagnation pressure at stagnation temperature > ambient pressure

$$E_p = -\Delta h + v_{st} [P_{st} - P_v^{Sat}(T_{st})] - v_{st} [P_v^{Sat}(T_{st}) - P_a]$$

For stagnation pressure at stagnation temperature \leq ambient pressure

$$E_p = v_{st} (P_{st} - P_a)$$

Δh = change of enthalpy between stagnation and post expansion conditions (Jkg^{-1})

v_{st} = Stagnation specific volume

P_{st} = Stagnation pressure (Nm^{-2})

P_a = Ambient pressure (Nm^{-2})

T_{st} = Stagnation temperature (K)

P_v^{Sat} = Saturated vapour pressure (Nm^{-2})

A monodisperse mist is assumed with a droplet size equal to this maximum droplet size, which leads to a discrete threshold where rainout is predicted to be non-existent or absolute. **(18)**

5.2 SHELL SHEPHERD

SHELL SHEPHERD is part of a risk assessment tool called HGSYSTEMS developed by Shell Global Solutions. The system performs risk assessments based on calculations of the physical engineering processes input from failure rates of components through to detailed analysis of resultant hazards.

Liquid releases are first analysed by phase at release temperature and ambient pressure. Liquids below their boiling point are modelled as spreading pools, fluids above their boiling points are assumed to fully convert to vapour clouds.

However version 1.0.4.5, current as at October 2003, does not calculate mist formation. Released liquid either forms a pool through rainout or is assumed to evaporate and behave as a vapour. Calculation of the degree of rainout is left to the user. (19) (20)

5.3 EJECT

Eject is a two-phase steady state jet release model developed for the HSE by AEA Technology. It is designed to calculate the downstream dispersion of hazardous substances close to the release point. It accounts for flashing conditions upon release as well as two-phase releases and assumes a five-component system (single component, two phase release; two-phase water and air).

EJECT calculates an immediate change in the vapour/liquid composition due to flashing upon release and assumes a thermodynamic equilibrium between the phases.

However, the model assumes a uniform mixture of both liquid and vapour phases travelling at the same characteristic velocity. No attempt is made to model the droplet size distribution and total rainout is assumed to occur when the effect of gravity moves the jet plume incident to the ground. (21)

5.4 RELEASE

This model has been developed by the American Institution of Chemical engineering and again uses the critical Weber number, as written above, to define the mean droplet diameter for mechanical break up. This is then used to calculate a lognormal distribution of droplet sizes around the mean.

$$\exp[\ln(\bar{\lambda}) \pm 3 \ln(s_G)]$$

$$\text{Where, } \bar{\lambda} = [We_{crit}]^{1/2} \sigma / (\rho_g u^2), \quad s_G = [We_{crit}]^{1/6}$$

$$\bar{\lambda} = \text{Geometric mean wavelength of instability (m}^{-1}\text{)}$$

$$s_G = \text{Standard deviation of mean droplet size normalised to mean droplet size (m)}$$

Flashing break up is predicted by modifying the critical Weber number equation. The RELEASE model simply replaces the velocity at the orifice with a relative velocity.

$$u_{Rel} = \sqrt{u_b^2 + u_{Acc}^2}$$

$$\text{Where, } u_{Acc} = u_{exp} - u_O, \quad u_b = \frac{\phi^2 C_{bub}^2}{N_d^{-1/3}}$$

$$u_{exp} = \text{Expansion velocity (ms}^{-1}\text{)}$$

u_b = Bubble growth velocity (ms^{-1})

ϕ = Corrective term to entrainment rate

C_{bub} = Bubble growth rate ($\text{ms}^{-1/2}$)

N_d = Density number of vaporization nucleation sites

The overall average droplet size is predicted to be the minimum of either the flashing or mechanical break up values. (22)

5.5 DUNBAR

Additionally, the HSE investigated the possibility of toxic liquids forming mists upon accidental release from pressurised storage/distribution. Dunbar et al conducted a literature review and developed a model for mechanical break up. The review identified a series of mechanisms for jet break up with transitions between the mechanisms determined by Weber number with a lowest threshold of 12.

A study has been identified that measured the distribution of droplet sizes and found it was approximately lognormal for all mechanisms except one. The “bag break up” mechanism for droplets with a Weber number between 12 and 50 shattered into a bi-model distribution with a peak just beneath the critical Weber number and at a much smaller diameter.

The review recommended the following empirical correlation for determining the sauter mean diameter from mechanical break up which was derived from experiments using diesel injectors.

$$d = 3.09\nu^{0.385}(\sigma\rho_l)^{0.737}\rho_a^{0.06}\Delta P^{-0.54}$$

Where, ν = Kinematic viscosity (m^2s^{-1})

ρ_l = Density of liquid (kgm^3)

ΔP = Pressure difference (Pa)

Dunbar then went on to develop a model for the dispersion of the resulting mist including the evaporative mass reduction of the droplet although without experimental validation the accuracy of the predictions are unknown.

$$dm/dt = -2\pi dM_v D(p/T_d - p_a/T_a)/R$$

Where, dm/dt = Change of mass with time

d = Diameter of droplet

M_v = Molecular weight

D = Diffusion coefficient of vapour in air

p = Pressure at droplet surface

R = Gas constant

(23) (24)

5.6 TNO

TNO use a series of mathematical equations to model the release of pressurised liquids. They initially calculate the effect of expansion on the orifice conditions. By changing the pressure to ambient they recalculate the jet density and velocity by preserving the momentum and mass, then calculate the degree of vaporization by preserving the total energy.

These post expansion conditions are used to calculate the Reynolds and Weber numbers, which define whether the jet break-up shatters or not. Two correlations are proposed.

- If $We < Re^{-0.45} * 10^6$ and $T < 1.11T_B$ then

$$D_d = 3.78r_j \sqrt{\left(1 + 3 \frac{We^{1/2}}{Re}\right)}$$

Where D_d = Diameter of droplet

T_B = Normal boiling temperature

r_j = Radius of jet

- Otherwise

$$D_d = 15 \frac{\sigma_L}{u_j^2 \rho_a}$$

Where u_j = Velocity of jet

No attempt is made to model the scenario of releases from pressurised high flashpoint liquids or multi-component systems. (25)

5.7 SUPERCHEMS

SuperChems is another commercial program that is used to calculate hazard ranges from process plant work. It also uses two calculations depending on whether the forces driving the break-up are mechanical or thermal. The calculation of mechanically derived droplet diameter distributions uses the critical Weber number described under PHAST although modified by the viscosity of the fluid.

For flashing break-up, SuperChems uses the same equation to define a critical Weber number but replaces the square of the jet velocity with the available energy after expansion. A value of 140 is used to fit the model results to rainout data collected during the CCPS trials below. **(26)**

6 EXPERIMENTS

6.1 CCPS

Few large-scale experiments have been performed to validate two-phase release model results. The first of these experiment trials was in 1989 and involved the release of water and CFC-11 over a range of temperatures around their boiling points. Unfortunately the experiments only measured the mass of liquid rainout not the mist droplets so cannot be used to help determine the orifice conditions.

The second of these trials was in 1990 and tried to extend the original correlations to other substances. Chlorine, methylamine and cyclohexane were released. Again only the liquid rainout was measured not the orifice conditions but a similar trend was demonstrated.

For all substances, the proportion of rainout decreased as the temperature increased. A gentle, regressive linear relationship was determined for temperatures from the normal boiling point to a transitional point in the superheated fluid region. Above this transitional point, the proportion of rainout decreased much more sharply.

The RELEASE model predictions are compared to the observed rainouts, corrected for evaporative and plume losses, but since RELEASE is used to back calculate the initial droplet diameter the data is already tailored and the data sets are not objective. (27) (28) (29) (30)

6.2 STEP

At around the same time an experimental research program looking at chemical hazards was established by the EC. Part of this involved the use of a laser system to measure liquid droplet size and velocity inside a release jet.

A test program of 31, 5-litre releases of propane was performed with a range of pressures from 5 to 17 bar and orifice sizes from 2 to 8 mm. Whilst the degree of superheat was not varied, the direct measurement of droplet sizes and distributions provides a database for flashing break-up modelling. (31)

6.3 VON KARMAN INSTITUTE

The Von Karman Institute for Fluid Dynamics has also done some experimental studies as part of an EC research project for the purpose of generating experimental data for model validation. They studied releases of tetra-fluoro-ethane and varied the orifice diameter (1-4 mm), pressure (8-12 bar) and superheat (43-49 °C). They also review the experimental work of other researchers.

Their experiments conclude that both droplet diameter and velocity are higher in the centre of the jet than the edge and decrease with distance from the orifice. Greater driving pressures and superheats lead to a more violent break-up and smaller droplets, unlike larger orifice sizes, which causes larger droplet diameters. This latter relationship is in contention but both Yildiz and Hervieu report that orifice size has a positive correlation with droplet diameter.

As a matter of interest to flammability studies, Yildiz reports both the sauter mean diameter and the arithmetic mean diameter for the same releases demonstrating that the majority of droplets are of the order of two thirds to half the sauter mean diameter. (32)

6.4 MOBIL

A two-phase mist generation model has been developed and tested by Muralidhar & Sundaresan for predicting rainout from both liquid and superheated HF releases. They found from a series of experimental trials, measuring the HF rainout, that the best mechanical break-up correlation was a critical Weber number derived from the release velocity rather than the velocity square, as in the PHAST model.

$$D_d = 0.96 \frac{\sigma}{u}$$

Where D_d = Diameter of droplet
 σ = Surface tension (Nm^{-1})
 u = Initial velocity (ms^{-1})

The correlation produces a good fit to their experimental data but only the captured rainout was recorded rather than the droplet diameters. No flashing releases were recorded. (33)

6.5 HSL

Flashing propane releases were investigated by HSL to measure near-field conditions including droplet diameter, velocities and temperatures. This was done by non-intrusive laser techniques to produce axial and lateral profiles of jet velocity and droplet diameter.

Initial pressure, degree of superheat and orifice sizes were varied to produce a body of data specifically for validation of computational models. Further work was carried out to investigate rainout and the effect of impingement of the jet. (34) (35) (36) (37) (38)

6.6 WORK ON MULTI-COMPONENT RELEASES

Because of the complexity of characterising two-phase releases, almost all work to date has been on single component fluids. However for industry, particularly the petrochemical industry, releases of interest involve complex component mixtures. Models attempt to cover these scenarios by either assuming the fluid splits into vapour cloud and liquid pools or by assuming ideal mixing of the components into a homogenous fluid with the properties of the weighted average of the components.

A theoretical comparison of this substitute method has been studied by Johnson et al who conclude that substitute single component models only produce equivalent results for single-phase releases. (39)

Johnson et al only modelled the range to the lower flammability limit while a recent study by Witlox et al tried to extend the capabilities of PHAST to model multi-component fluids. The method chosen involved cubic equations of state that can model non-polar mixtures, which deviate from ideal mixing behaviour. **(40)**

7 FLASHING LIQUID JET JIP

Recently a series of joint industry projects have been set up to investigate the phenomena of flashing superheated jets. The first of these took the form of a literature survey that reviewed the current 'state of the art' in two-phase droplet dispersion modelling. It found that only two models attempted to calculate the initial droplet break-up. These were PHAST and the work of Muralidar et al.

Once this had been determined, the second stage of the JIP undertook experimental releases of superheated water and used a phase doppler anemometer to measure the resultant droplet diameters. This produced results for the sauter mean diameters and the droplet size distributions. This was then used to validate a proposed new droplet size correlation.

Mechanical break-up

For $2 < L / d_o < 50$

$$\frac{D_d}{d_o} = 64.73 * We_{LO}^{-0.533} * Re_{LO}^{-0.014} * \left(\frac{L}{d_o} \right)^{0.114}$$

Where $Re_{LO} = \frac{\rho_L u_o d_o}{\mu_L}$ $We_{LO} = \frac{\rho_L u_o^2 d_o}{\sigma_L}$

D_d = Droplet diameter

d_o = Orifice diameter

We_{LO} = Weber number of the liquid at the orifice

Re_{LO} = Reynolds number of the liquid at the orifice

L = Thickness of the vessel wall

ρ_L = Liquid density

u_o = Release velocity

μ_L = Liquid dynamic viscosity

σ_L = Liquid surface tension

The transition to flashing break-up is assumed to reduce the sauter mean diameter by 2.4 after which it drops by 0.1 $\mu\text{m/K}$.

A third phase of this JIP is currently being developed in which it is intended to perform additional small-scale water releases, large scale butane releases and further develop the PHAST computational model.

(41) (42)

8 DISCUSSION

8.1 CONCLUSIONS

1. The combustion behaviour of fuel mists have been summarised and the burning properties of droplets sizes less than 30 µm have been highlighted as particularly hazardous. It is known that optically thick flammable mixtures are preheated by the radiative output of the flame front and produce much higher flame speeds. The case has been made that these scenarios need to be included in hazard assessment to reduce risk to life and property. **(43)**
2. The offshore hydrocarbon release statistics for the past 5½ years have been analysed to identify reported cases of flash-fires of high flash point fuels. There have been thirty-five flash-fires of non-process oils and diesel and three flash-fires of process hydrocarbons (not including the 'gas' category).
3. An empirical correlation has been used to calculate, from the number of reported hydrocarbon releases, the number of releases that may have formed a flammable mist. Shell Research Ltd has proposed this correlation for use in identifying hazardous areas. This study found that 45% of hydrocarbon releases (96% of liquid releases) occurred under conditions that could have formed droplets within the flammable size range.
4. The correlation is deliberately cautious but records of the ignited releases show that, of the non-jet fires, 78 % of fires occurred as explosions or flash-fires rather than pool fires demonstrating that realistic release conditions favour significant airborne dispersion over rainout.
5. Current industrial modelling methods have been identified and a short review of the break-up correlations used in key programs has been undertaken. Demonstration has been made that industry is aware of the current lack of knowledge of aerosol generation and steps are being taken to resolve this but the focus remains on single component, superheated gases rather than multi-component process fluids and high flashpoint hydrocarbons.

8.2 RECOMMENDATIONS

1. Awareness of the potential hazards associated with high flashpoint liquids needs to be raised within the process safety industry. Pressurised hydrocarbon fluids need to be considered during risk assessments.
2. Consider revision of OIR12 form to include the presence of mist, area of pool/rainout and more details of the released hydrocarbon, eg. Product datasheet for non-process hydrocarbons and compositions for process hydrocarbons.
3. Experimental work is needed to validate droplet size correlations against realistic release scenarios (high flashpoint hydrocarbons and multi-component process fluids) instead of single phase pressurised gases and atypical polar fluids.
4. Further experimental work is needed to understand the mechanisms of accelerated flame propagation and associated higher overpressures within preheated optically thick fuel mixtures.

9 APPENDICES

Table A.1. -Offshore data from 2000-2001

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
1	GAS		MINOR		4.7	1	NO					
2	OIL		MINOR	799.12	1	7	NO					
3	GAS		MAJOR		50.5	54	NO					
4	GAS		SIGNIFICANT		1	20	NO					
5	GAS		SIGNIFICANT		1	140	NO					
6	OIL		MINOR	924.98138	1	9.3000002	NO					
7	GAS		MAJOR		17.3	168	NO					
8	OIL		SIGNIFICANT	813.10461	5.8	3	NO					
9	GAS		MINOR		1	28	NO					
10	GAS		MINOR		N/A	1	NO					
11	GAS		MINOR		N/A	0	NO					
12	OIL		MINOR	849.065	1	0.5	NO					
13	GAS		SIGNIFICANT		1	45	NO					
14	GAS		SIGNIFICANT		1	3.5	NO					
15	GAS		SIGNIFICANT		1	36	NO					
16	GAS		MINOR		9.525	3.448276	NO					
17	GAS		SIGNIFICANT		1.9	11	NO					
18	GAS		SIGNIFICANT		1.3	50	NO					
19	2-PHASE		MAJOR	799.12	3.8	75	NO					
20	GAS		MINOR		1	44	NO					
21	OIL		MINOR	980	2.2	0.1	NO					
22	GAS		MINOR		1	9	NO					
23	OIL		SIGNIFICANT	785.13538	1.6	4	NO					
24	GAS		SIGNIFICANT		7	31	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE_DIAM	ACT_PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
25	GAS	LUB OIL	MINOR		1	15	NO					
26	NON-PROCESS		SIGNIFICANT	799.12	6	14	NO					
27	OIL		SIGNIFICANT	839.07599	22.6	5	NO					
28	CONDENSATE		MINOR	779.14203	3	51	NO					
29	OIL		MINOR	849.065	9	2	NO					
30	GAS		MINOR		1	30	NO					
31	OIL		SIGNIFICANT	834.08148	12	46	NO					
32	GAS		SIGNIFICANT		16	2	NO					
33	GAS		SIGNIFICANT		12.7	137.931	NO					
34	GAS		MINOR		1	30	NO					
35	NON-PROCESS		MINOR	799.12	1	0.37931001	NO					
36	2-PHASE		SIGNIFICANT	948.95502	8	10.5	NO					
37	NON-PROCESS	DIESEL	MINOR	699.22998	1	2	NO					
38	NON-PROCESS	HELIFUEL	MINOR	699.22998	1.2	7	NO					
39	2-PHASE		SIGNIFICANT	833.78192	1.2	20	NO					
40	GAS		SIGNIFICANT		1	25	NO					
41	CONDENSATE		SIGNIFICANT	599.34003	7.1	0	NO					
42	GAS		MAJOR		8.1	25.517241	NO					
43	GAS		MINOR		1	8.5	NO					
44	2-PHASE		MINOR	799.12	1	74	NO					
45	GAS		SIGNIFICANT		7.9	66	NO					
46	GAS		SIGNIFICANT		16.5	3	NO					
47	GAS		SIGNIFICANT		13.7	3	NO					
48	GAS		SIGNIFICANT		5	270	NO					
49	OIL		SIGNIFICANT	799.12	1.1	100	NO					
50	GAS	HYDRAULIC OIL	MINOR		1	0	NO					
51	GAS		SIGNIFICANT		1	124.1379	NO					
52	GAS		SIGNIFICANT		2.3	1.3	NO					
53	NON-PROCESS		SIGNIFICANT	699.22998	4.5	50	NO					
54	CONDENSATE		SIGNIFICANT	599.34003	1	80.689651	NO					
55	OIL		MINOR	799.12	10	0	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
56	GAS		MINOR		1	17	YES	IMMEDIATE	1			
57	GAS		SIGNIFICANT		26.5	16	NO					
58	GAS		MINOR		1	3.5	NO					
59	NON-PROCESS	DIESEL	MINOR	799.12	1.6	123.987	YES	IMMEDIATE	1			
60	GAS		SIGNIFICANT		2.9	322	NO					
61	GAS		MINOR		4.1	1.14E-08	YES	IMMEDIATE	1			
62	NON-PROCESS	DIESEL	SIGNIFICANT	799.12	29.7	1.14E-08	NO					
63	OIL		MINOR	799.12	2.2	0	NO					
64	GAS		MINOR		N/A	0	NO					
65	NON-PROCESS	DIESEL	SIGNIFICANT	799.12	2.2	10	NO					
66	2-PHASE		SIGNIFICANT	799.12	1	28	NO					
67	NON-PROCESS	METHANOL	MINOR	799.12	1	786.20691	NO					
68	GAS		SIGNIFICANT		N/A	1.14E-08	NO					
69	GAS		SIGNIFICANT		4.1	124.1379	NO					
70	NON-PROCESS	METHANOL	MINOR	799.12	1	350	NO					
71	2-PHASE		SIGNIFICANT	799.12	1	72.413803	NO					
72	GAS		MINOR		1.82	90	NO					
73	GAS		MINOR		7.7	1.14E-08	NO					
74	GAS		MINOR		1	3.0869999	NO					
75	NON-PROCESS	DIESEL	MINOR	799.12	14.7	1	NO					
76	GAS		MINOR		10	0.5	NO					
77	GAS		SIGNIFICANT		2	44.827591	NO					
78	OIL		MINOR	833.78192	1	78.987	NO					
79	GAS		SIGNIFICANT		5	32	NO					
80	GAS		MINOR		1	16	NO					
81	GAS		SIGNIFICANT		1	130	NO					
82	GAS		MINOR		3	0.30000001	NO					
83	2-PHASE		MINOR	948.95502	1	9.8000002	NO					
84	OIL		SIGNIFICANT	769.15302	5	12.41379	NO					
85	2-PHASE		MINOR	810	1	28	NO					
86	GAS		MINOR		1.6	5	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
87	NON-PROCESS	DIESEL	MINOR	799.12	1.3	17.241381	NO					
88	GAS		SIGNIFICANT		10	206.8965	NO					
89	GAS		MINOR		1	16	NO					
90	GAS		MINOR		1.3	7.5862069	NO					
91	GAS		MINOR		1	13.7931	NO					
92	2-PHASE		MINOR	842.07269	1	51.72414	NO					
93	OIL		MINOR	978.922	1	12	NO					
94	OIL		SIGNIFICANT	948.95502	4.4	8	NO					
95	GAS		SIGNIFICANT		1	24	NO					
96	GAS		SIGNIFICANT		1.21	75	NO					
97	OIL		MINOR	862	3.8	0	NO					
98	OIL		SIGNIFICANT	825	9.6	19	NO					
99	CONDENSATE		SIGNIFICANT	759.164	6	18.889999	NO					
100	GAS		SIGNIFICANT		1	128	NO					
101	NON-PROCESS		MINOR	849.065	1.5	2.3	NO					
102	GAS		SIGNIFICANT		3.2	20	NO					
103	GAS		SIGNIFICANT		3.2	20	NO					
104	CONDENSATE		MINOR	599.34003	1	34.482761	NO					
105	GAS		MINOR		15.8	0.025	NO					
106	GAS		MAJOR		5	90	NO					
107	GAS		SIGNIFICANT		1.8	80	NO					
108	NON-PROCESS	LUB OIL	MINOR	799.12	1	5	YES	IMMEDIATE	1			
109	GAS		MINOR		1	4	NO					
110	CONDENSATE		MINOR	699.22998	2.2	19	NO					
111	GAS		MINOR		1	163	NO					
112	GAS		MINOR		3.6	1	NO					
113	GAS		SIGNIFICANT		11.67	19	NO					
114	OIL		MINOR	749.17499	1	100	NO					
115	GAS		MINOR		1	21	NO					
116	GAS		SIGNIFICANT		19.5	0.1	NO					
117	GAS		SIGNIFICANT		1	26	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
118	GAS	METHANOL	SIGNIFICANT	799.12	1.6	122	NO	DELAYED	1		1	
119	GAS		SIGNIFICANT		1.9	20	NO					
120	GAS		SIGNIFICANT		1	24	NO					
121	NON-PROCESS		MINOR		3	310	NO					
122	GAS		SIGNIFICANT		1	46	NO					
123	GAS		SIGNIFICANT	768	1	150	NO					
124	OIL		MINOR		1	1	NO					
125	GAS		SIGNIFICANT		2.9	130	NO					
126	GAS		MINOR		1	20	NO					
127	GAS		MINOR		1	0	NO					
128	OIL		SIGNIFICANT	799.12	3.1	10	NO					
129	2-PHASE		SIGNIFICANT	799.12	3.7	7	NO					
130	2-PHASE		SIGNIFICANT	799.12	1	25	NO					
131	2-PHASE		SIGNIFICANT	948.95502	1	9	NO					
132	GAS	MINOR	1	19	NO							
133	GAS	SIGNIFICANT	1	103.4483	YES							
134	CONDENSATE	MINOR	599.34003	1	0	NO						
135	NON-PROCESS	DIESEL	MINOR	799.12	6.3	5	YES	IMMEDIATE	1			
136	OIL		MINOR	799.12	2.2	0	YES					
137	OIL		MINOR	938.966	1	6.5	NO					
138	2-PHASE		SIGNIFICANT	799.12	1.1	73.103447	NO					
139	OIL		MINOR	938.966	1	6.5	NO					
140	OIL	MINOR	799.12	2.2	3.70E-02	NO						
141	GAS	SIGNIFICANT	599.34003	3.5	2	NO						
142	NON-PROCESS	BOTTLED GAS		MINOR	1	1	NO					
143	NON-PROCESS	METHANOL		MINOR	799.12	1	15	NO				
144	2-PHASE	SIGNIFICANT		799.12	1	39	NO					
145	GAS	MINOR		1	222	NO						
146	OIL	MINOR	843.17151	1.5	6.8965521	NO						
147	GAS	MINOR		1.3	90	NO						
148	GAS	MINOR		3	1.14E-08	NO						

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
149	GAS	DIESEL	MAJOR		41.4	0.02	NO					
150	GAS		MINOR		1	117	NO					
151	GAS		SIGNIFICANT		18.5	16.55172	NO					
152	OIL		SIGNIFICANT	799.12	10	7	NO					
153	GAS		SIGNIFICANT		1	180	NO					
154	GAS		MAJOR		51.5	90	NO					
155	OIL		SIGNIFICANT	799.12	6.35	38	NO					
156	OIL		MINOR	819.09802	1	10	NO					
157	GAS		SIGNIFICANT		5.8	0.5	NO					
158	OIL		MINOR	839.07599	17	2	NO					
159	GAS		SIGNIFICANT		6.3	1.14E-08	NO					
160	OIL		SIGNIFICANT	948.95502	4	0.69999999	NO					
161	OIL		SIGNIFICANT	799.12	43.4	0	NO					
162	GAS		MINOR		3.38	1.14E-08	NO					
163	GAS		MINOR		5.6	1.14E-08	NO					
164	OIL		SIGNIFICANT	799.12	>100	0	NO					
165	NON-PROCESS		MINOR	830	1	43	NO					
166	CONDENSATE		MINOR	649.28497	1	1	NO					
167	GAS		SIGNIFICANT		1.4	120	NO					
168	GAS		SIGNIFICANT		10	2	NO					
169	OIL		MINOR	968.93298	1.8	3.5	NO					
170	GAS		MINOR		3	0	NO					
171	OIL		SIGNIFICANT	845.0694	N/A	0	NO					
172	OIL		MINOR	718.20911	1	215	NO					
173	OIL		SIGNIFICANT	800	2	3.55	NO					
174	OIL		MINOR	829.08698	5.4	0	NO					
175	2-PHASE		SIGNIFICANT	829.08698	16.1	0	NO					
176	GAS		MINOR		1	56	NO					
177	2-PHASE		SIGNIFICANT	829.08698	2.6	0	NO					
178	NON-PROCESS	DIESEL	MINOR	799.12	1	40	YES	IMMEDIATE				1
179	2-PHASE		SIGNIFICANT	830	1	68.965523	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
180	GAS	DIESEL	MINOR	800	1	166.987	NO					
181	GAS		SIGNIFICANT		3.5	74	NO					
182	GAS		SIGNIFICANT		4	15	NO					
183	GAS		SIGNIFICANT		4	40	NO					
184	OIL		MINOR		1	7	NO					
185	GAS		MINOR		1	63	NO					
186	NON-PROCESS		MINOR		1	8.2758617	NO					
187	GAS		MINOR		1.3	35	NO					
188	OIL		MINOR		1	260	NO					
189	2-PHASE		SIGNIFICANT		1	35	NO					
190	GAS		SIGNIFICANT		1	103.4483	NO					
191	2-PHASE		SIGNIFICANT		3.6	80	NO					
192	GAS		SIGNIFICANT		23.7	12	NO					
193	GAS		SIGNIFICANT		1.2	154	NO					
194	NON-PROCESS	DIESEL	MINOR	799.12	1	110	YES	IMMEDIATE	1			
195	GAS	LUB OIL	MINOR	886.02429	1	26	NO	IMMEDIATE	1			
196	NON-PROCESS		MINOR		1.6	80.987	YES					
197	GAS	METHANOL	SIGNIFICANT	799.12	1	90	NO					
198	NON-PROCESS		MINOR		1	0.5	NO					
199	CONDENSATE		MINOR		1	275.70001	NO					
200	GAS		SIGNIFICANT		12.4	1	NO					
201	GAS	BOTTLED GAS	SIGNIFICANT	599.34003	3	38	NO					
202	CONDENSATE		SIGNIFICANT		5	35	NO					
203	OIL		MINOR		1	2	NO					
204	OIL		MINOR		2.8	2	NO					
205	GAS		MINOR		4.7752	0.5	NO					
206	GAS		SIGNIFICANT		1	87.5	NO					
207	NON-PROCESS		MINOR		1	3.5	NO					
208	2-PHASE		MINOR		1	10	NO					
209	OIL		MINOR		1	3	NO					
210	GAS		MINOR		1	18	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
211	OIL		SIGNIFICANT	844.0705	3.5	7.3000002	NO					
212	2-PHASE		MINOR	799.12	1	12.5	NO					
213	GAS		MINOR		2.4	12	NO					
214	GAS		MINOR		92	1	NO					
215	CONDENSATE		MINOR	649.28497	1	50	NO					
216	2-PHASE		SIGNIFICANT	799.12	3.3	10	NO					
217	GAS		SIGNIFICANT		1	18.34	NO					
218	GAS		SIGNIFICANT		4	14.987	NO					
219	GAS		MINOR		1	20.689659	YES	IMMEDIATE			1	
220	GAS		SIGNIFICANT		1	158.6207	NO					
221	GAS		SIGNIFICANT		1.5	1.5	NO					
222	OIL		MINOR	938.966	1	6.5	NO					
223	OIL		MINOR	799.12	1	94	NO					
224	GAS		MINOR		5.3	5.00E-02	NO					
225	CONDENSATE		MINOR	869.04303	5.3	0	NO					
226	GAS		SIGNIFICANT		17.7	27.58621	NO					
227	GAS		SIGNIFICANT		1.4	131.0345	NO					
228	GAS		SIGNIFICANT		6.3	3	NO					
229	GAS		MAJOR		11.0797	25	NO					
230	GAS		SIGNIFICANT		1	160	NO					
231	GAS		MINOR		1	149	NO					
232	GAS		SIGNIFICANT		3	206.8965	NO					
233	GAS		MINOR		1	150	NO					
234	OIL		MINOR	799.12	1	2	NO					
235	GAS		SIGNIFICANT		1	131.72411	NO					
236	GAS		SIGNIFICANT		25.4	28	NO					
237	GAS		MINOR		1	118	NO					
238	OIL		MINOR	799.12	1	12.5	NO					
239	OIL		MINOR	799.12	23	62.06897	NO					
240	GAS		SIGNIFICANT		12.9	8.8000002	NO					
241	OIL		MINOR	799.12	2.2	1.14E-08	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
242	OIL		MINOR	799.12	1	12	NO					
243	GAS		MINOR		1.1	9	NO					
244	NON-PROCESS	BOTTLED GAS	MINOR	599.34003	2.9	6	NO					
245	OIL		MINOR	799.12	4.4	0.066	NO					
246	NON-PROCESS	DIESEL	MINOR	799.12	1	4	NO					
247	GAS		MINOR		1	40	NO					
248	GAS		MINOR		1	10	NO					
249	OIL		MINOR	820	1	3.0869999	NO					
250	OIL		MINOR	820	1	3.0869999	NO					
251	GAS		SIGNIFICANT		10	25	NO					
252	GAS		SIGNIFICANT		1	315	NO					
253	NON-PROCESS	DIESEL	MINOR	849.065	1	0.68965518	YES	IMMEDIATE			1	
254	NON-PROCESS	LUB OIL	SIGNIFICANT	799.12	2.4	10	NO					
255	OIL		MINOR	829.48657	3	8	NO					
256	GAS		MINOR		1	30	NO					
257	OIL		MINOR	799.12	1	2	NO					
258	CONDENSATE		MINOR	649.28497	N/A	1	NO					
259	NON-PROCESS	DIESEL	MINOR	799.12	1	1	NO					
260	GAS		MINOR		4	3.5	NO					
261	GAS		SIGNIFICANT		1	167	NO					
262	GAS		SIGNIFICANT		1	182	NO					
263	OIL		MINOR	808	1	1.5	NO					
264	OIL		MINOR	799.12	1	62	NO					
265	NON-PROCESS	HYDRAULIC OIL	MINOR	799.12	2.6	20.689659	NO					
266	OIL		MINOR	799.12	10.2	0	NO					
267	NON-PROCESS	DIESEL	SIGNIFICANT	799.12	6.7	4	NO					
268	NON-PROCESS	DIESEL	SIGNIFICANT	799.12	17.2	0.55172402	YES	IMMEDIATE	1			
269	OIL		MINOR	799.12	15.8	1.14E-08	NO					
270	NON-PROCESS	DIESEL	MINOR	849.065	2.2	130	NO					

Table A.2. -Analysis of offshore data from 2000-2001

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1								0	0
2	33.48482278	0.008	0.017	0.000932439	15.75756366	0.26086416	0.031101018	1	0
3								0	0
4								0	0
5								0	0
6	35.87401361	0.008	0.017	0.001003185	16.88188876	0.278815213	0.033241197	1	0
7								0	0
8	21.73163492	0.008	0.017	0.002265174	10.22665173	0.58506257	0.069752939	1	0
9								0	0
10								0	0
11								0	0
12	8.681994724	0.008	0.017	0.000961136	4.085644576	0.268160053	0.031970857	1	0
13								0	0
14								0	0
15								0	0
16								0	0
17								0	0
18								0	0
19								1	0
20								0	0
21	3.614031612	0.008	0.017	0.001531577	1.700720758	0.409766207	0.048853573	1	0
22								0	0
23	25.5365784	0.008	0.017	0.001169087	12.01721336	0.320479546	0.038208546	1	0
24								0	0
25								0	0
26	47.35469051	0.00714	0.03	0.002707949	11.27041634	0.688276007	0.082058358	1	0
27	27.61781652	0.008	0.017	0.004542232	12.99661954	1.101982972	0.131381761	1	0
28	91.5338557	0.000248	0.01843	5.14735E-05	1.231708964	0.018689626	0.002228234	1	0
29	17.36398945	0.008	0.017	0.002883408	8.171289152	0.728743047	0.086882962	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
30								0	0
31	84.01941659	0.008	0.017	0.003299965	39.53854898	0.823954594	0.098234372	1	0
32								0	0
33								0	0
34								0	0
35	7.794641344	0.0232	0.024	0.003212918	7.534819966	0.80415256	0.095873514	1	0
36								1	0
37	19.13418472	0.0232	0.024	0.003005409	18.49637856	0.756749439	0.090221969	1	0
38	35.7967818	0.0016	0.026	0.000236324	2.20287888	0.074808587	0.008918907	1	0
39								1	0
40								0	0
41	0	0.000248	0.01843	6.94513E-05	0	0.024546454	0.002926503	0	0
42								0	0
43								0	0
44								1	0
45								0	0
46								0	0
47								0	0
48								0	0
49	126.560734	0.008	0.017	0.00097795	59.55799245	0.272425707	0.032479421	1	0
50								0	0
51								0	0
52								0	0
53	95.6709236	0.00714	0.03	0.002193689	22.76967982	0.568236548	0.067746889	1	0
54	131.2735593	0.000248	0.01843	2.60646E-05	1.766459181	0.010061581	0.001199572	1	0
55	0	0.008	0.017	0.002948631	0	0.743728485	0.088669572	0	0
56								0	1
57								0	0
58								0	0
59	140.9246811	0.0232	0.024	0.004064055	136.2271917	0.995893829	0.118733491	1	1
60								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
61								0	1
62	0.001353909	0.0232	0.024	0.017509665	0.001308779	3.762206535	0.448541703	0	0
63	0	0.008	0.017	0.001383031	0	0.373436475	0.044522232	0	0
64								0	0
65	40.02201817	0.0232	0.024	0.004765527	38.68795089	1.151173461	0.137246401	1	0
66								1	0
67	354.8684691	5.44E-04	0.0226	7.3107E-05	8.541966691	0.025719505	0.003066358	1	0
68								0	0
69								0	0
70	236.7734526	5.44E-04	0.0226	7.3107E-05	5.699325584	0.025719505	0.003066358	1	0
71								1	0
72								0	0
73								0	0
74								0	0
75	12.6560734	0.0232	0.024	0.012318513	12.23420428	2.731919112	0.325707704	1	0
76								0	0
77								0	0
78	110.1175544	0.008	0.017	0.000952447	51.82002561	0.265952961	0.031707721	1	0
79								0	0
80								0	0
81								0	0
82								0	0
83								1	0
84	45.45177071	0.008	0.017	0.00204553	21.38906857	0.533203643	0.06357016	1	0
85								1	0
86								0	0
87	52.55148699	0.0232	0.024	0.00366329	50.79977076	0.906113653	0.108029625	1	0
88								0	0
89								0	0
90								0	0
91								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
92								1	0
93	39.61152508	0.008	0.017	0.001032021	18.64071768	0.286098997	0.034109592	1	0
94	32.84937905	0.008	0.017	0.002131393	15.45853132	0.553533212	0.065993913	1	0
95								0	0
96								0	0
97	0	0.008	0.017	0.001887817	0	0.495659344	0.059094014	0	0
98	54.2943716	0.008	0.017	0.002935466	25.55029252	0.740706085	0.088309232	1	0
99	56.43560038	0.000248	0.01843	7.18551E-05	0.759415567	0.025318407	0.003018538	1	0
100								0	0
101	18.6208042	0.0232	0.024	0.00405611	18.00011072	0.994121895	0.118522235	1	0
102								0	0
103								0	0
104	85.8162155	0.000248	0.01843	2.60646E-05	1.154770561	0.010061581	0.001199572	1	0
105								0	0
106								0	0
107								0	0
108	28.29984044	0.00714	0.03	0.001105516	6.735362025	0.304581704	0.036313157	1	1
109								0	0
110	58.97551811	0.000248	0.01843	4.17576E-05	0.793593516	0.015450029	0.001841999	1	0
111								0	0
112								0	0
113								0	0
114	130.7113649	0.008	0.017	0.00090283	61.51123052	0.253315254	0.030201015	1	0
115								0	0
116								0	0
117								0	0
118								0	0
119								0	0
120								0	0
121	222.8331665	5.44E-04	0.0226	0.000126625	5.363771795	0.042398723	0.005054905	1	0
122								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
123								0	0
124	12.90994449	0.008	0.017	0.000914103	6.075267994	0.25619185	0.030543971	1	0
125								0	0
126								0	0
127								0	0
128	40.02201817	0.008	0.017	0.001641728	18.8338909	0.436499736	0.052040826	1	0
129								1	0
130								1	0
131								1	0
132								0	0
133								0	1
134	0	0.000248	0.01843	2.60646E-05	0	0.010061581	0.001199572	0	0
135	28.29984044	0.0232	0.024	0.00806436	27.35651243	1.857968724	0.221512681	1	1
136	0	0.008	0.017	0.001383031	0	0.373436475	0.044522232	0	1
137	29.76711394	0.008	0.017	0.00101074	14.00805362	0.280725358	0.033468931	1	0
138								1	0
139	29.76711394	0.008	0.017	0.00101074	14.00805362	0.280725358	0.033468931	1	0
140	2.434442614	0.008	0.017	0.001383031	1.145620054	0.373436475	0.044522232	1	0
141								0	0
142								0	0
143	49.01676149	5.44E-04	0.0226	7.3107E-05	1.179872489	0.025719505	0.003066358	1	0
144								1	0
145								0	0
146	32.35661144	0.008	0.017	0.001173054	15.22664068	0.321469092	0.038326523	1	0
147								0	0
148								0	0
149								0	0
150								0	0
151								0	0
152	33.48482278	0.008	0.017	0.002948631	15.75756366	0.743728485	0.088669572	1	0
153								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
154								0	0
155	78.01727607	0.008	0.017	0.002349672	36.71401227	0.604890077	0.072116834	1	0
156	39.53093138	0.008	0.017	0.000944023	18.60279124	0.263811534	0.031452413	1	0
157								0	0
158	17.46704084	0.008	0.017	0.003939486	8.219783924	0.968076779	0.115417057	1	0
159								0	0
160	9.716977295	0.008	0.017	0.002032204	4.572695198	0.530041668	0.063193179	1	0
161	0	0.008	0.017	0.006142785	0	1.450348072	0.172914907	0	0
162								0	0
163								0	0
164	0	0.008	0.017					0	0
165	81.43294973	0.0232	0.024	0.003274407	78.71851807	0.818145453	0.097541789	1	0
166	14.04065312	0.000248	0.01843	2.71289E-05	0.188935538	0.010434772	0.001244065	1	0
167								0	0
168								0	0
169	21.50265752	0.008	0.017	0.001377519	10.11889766	0.372081944	0.044360741	1	0
170								0	0
171	0	0.008	0.017					0	0
172	195.748643	0.008	0.017	0.000883975	92.11700846	0.24849641	0.029626498	1	0
173	23.83275058	0.008	0.017	0.001319394	11.21541204	0.357767221	0.042654096	1	0
174	0	0.008	0.017	0.002207046	0	0.571384111	0.068122151	0	0
175								1	0
176								0	0
177								1	0
178	80.04403633	0.0232	0.024	0.003212918	77.37590179	0.80415256	0.095873514	1	1
179								1	0
180								0	0
181								0	0
182								0	0
183								0	0
184	33.46640106	0.008	0.017	0.000932952	15.74889462	0.260994827	0.031116597	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
185								0	0
186	36.4087356	0.0232	0.024	0.003212918	35.19511108	0.80415256	0.095873514	1	0
187								0	0
188	204.0730516	0.008	0.017	0.000932439	96.03437723	0.26086416	0.031101018	1	0
189								1	0
190								0	0
191								1	0
192								0	0
193								0	0
194	132.7380176	0.0232	0.024	0.003212918	128.313417	0.80415256	0.095873514	1	1
195								0	0
196	108.1657651	0.00714	0.03	0.001472454	25.7434521	0.395346323	0.047134391	1	1
197								0	0
198	8.949195322	5.44E-04	0.0226	7.3107E-05	0.215414259	0.025719505	0.003066358	1	0
199	213.0815302	0.000248	0.01843	2.96819E-05	2.867293516	0.011324719	0.001350167	1	0
200								0	0
201								0	0
202	86.45743849	0.000248	0.01843	5.82822E-05	1.163399064	0.020926546	0.002494927	1	0
203	16.63617528	0.008	0.017	0.001003185	7.828788367	0.278815213	0.033241197	1	0
204	17.36398945	0.008	0.017	0.001608288	8.171289152	0.428401504	0.05107533	1	0
205								0	0
206								0	0
207								0	0
208								1	0
209	21.92096215	0.008	0.017	0.000932439	10.31574689	0.26086416	0.031101018	1	0
210								0	0
211	33.27185846	0.008	0.017	0.001792825	15.65734516	0.472910802	0.056381864	1	0
212								1	0
213								0	0
214								0	0
215	99.28241031	0.000248	0.01843	2.71289E-05	1.335976004	0.010434772	0.001244065	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
216								1	0
217								0	0
218								0	0
219								0	1
220								0	0
221								0	0
222	29.76711394	0.008	0.017	0.00101074	14.00805362	0.280725358	0.033468931	1	0
223	122.7051842	0.008	0.017	0.000932439	57.74361607	0.26086416	0.031101018	1	0
224								0	0
225	0	0.000248	0.01843	7.22558E-05	0	0.025446858	0.003033852	0	0
226								0	0
227								0	0
228								0	0
229								0	0
230								0	0
231								0	0
232								0	0
233								0	0
234	17.89839064	0.008	0.017	0.000932439	8.422772068	0.26086416	0.031101018	1	0
235								0	0
236								0	0
237								0	0
238	44.74597661	0.008	0.017	0.000932439	21.05693017	0.26086416	0.031101018	1	0
239	99.7094347	0.008	0.017	0.004471821	46.92208692	1.086427076	0.12952714	1	0
240								0	0
241	0.001353909	0.008	0.017	0.001383031	0.000637134	0.373436475	0.044522232	0	0
242	43.84192429	0.008	0.017	0.000932439	20.63149379	0.26086416	0.031101018	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
243								0	0
244								0	0
245	3.251404126	0.008	0.017	0.001955901	1.53007253	0.511900299	0.06103031	1	0
246	25.31214679	0.0232	0.024	0.003212918	24.46840857	0.80415256	0.095873514	1	0
247								0	0
248								0	0
249	21.9516094	0.008	0.017	0.000944542	10.33016913	0.263943674	0.031468167	1	0
250	21.9516094	0.008	0.017	0.000944542	10.33016913	0.263943674	0.031468167	1	0
251								0	0
252								0	0
253	10.19648575	0.0232	0.024	0.0033118	9.856602893	0.826643235	0.09855492	1	1
254	40.02201817	0.00714	0.03	0.001712657	9.525240324	0.453628076	0.054082919	1	0
255	35.1354321	0.008	0.017	0.001645431	16.53432099	0.437395574	0.05214763	1	0
256								0	0
257	17.89839064	0.008	0.017	0.000932439	8.422772068	0.26086416	0.031101018	1	0
258	14.04065312	0.000248	0.01843					0	0
259	12.6560734	0.0232	0.024	0.003212918	12.23420428	0.80415256	0.095873514	1	0
260								0	0
261								0	0
262								0	0
263	15.41504987	0.008	0.017	0.000937605	7.254141113	0.262179134	0.031257794	1	0
264	99.65402158	0.008	0.017	0.000932439	46.89601015	0.26086416	0.031101018	1	0
265	57.56727221	0.00714	0.03	0.00178259	13.70101079	0.470453479	0.056088894	1	0
266	0	0.008	0.017	0.002977971	0	0.750459904	0.089472112	0	0
267	25.31214679	0.0232	0.024	0.008316431	24.46840857	1.910743911	0.227804699	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
268	9.400694313	0.0232	0.024	0.013324896	9.087337836	2.934295802	0.349835668	1	1
269	0.001353909	0.008	0.017	0.003706372	0.000637134	0.9158058	0.109185152	0	0
270	139.9929585	0.0232	0.024	0.004912193	135.3265265	1.183369675	0.141084931	1	0

Table A.3. -Offshore data from 2001-2002

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
1	NON-PROCESS	OIL BASED MUD	SIGNIFICANT	799.12	N/A	1.00E-02	NO					
2	OIL		SIGNIFICANT	798.40002	8.08177	0.91000003	NO					
3	GAS		MINOR		1.00602	5	NO					
4	2-PHASE		SIGNIFICANT	799.12	6.0189	172.42	NO					
5	GAS		SIGNIFICANT		1	170	NO					
6	2-PHASE		SIGNIFICANT	798.40002	1.99979	44.139999	NO					
7	GAS		SIGNIFICANT		1.03211	150	NO					
8	2-PHASE		MINOR	798.40002	3.54851	1.00E-02	NO					
9	NON-PROCESS	OIL BASED MUD	SIGNIFICANT	798.40002	29.8932	1.00E-02	NO					
10	GAS		SIGNIFICANT		9.5926	1.00E-02	NO					
11	OIL		MINOR	799.12	1	1	NO					
12	CONDENSATE		MINOR	750.17389	1	42	NO					
13	NON-PROCESS	DIESEL	MINOR	799.12	0.401	48.27586	NO					
14	OIL		SIGNIFICANT	807.12	6.35866	4	NO					
15	GAS		MINOR		1	35.5	NO					
16	NON-PROCESS		MINOR	798.40002	10.5582	0.69999999	NO					
17	OIL	DIESEL	SIGNIFICANT	798.40002	5.713	7.5	NO					
18	2-PHASE		SIGNIFICANT	798.40002	1	15.5	NO					
19	GAS		MINOR		1.95204	1	NO					
20	2-PHASE		MINOR	798.40002	1.45891	140	NO					
21	GAS		MINOR		1	120.7	NO					
22	GAS		MINOR		1	121.39	NO					
23	GAS		MINOR		1	5	NO					
24	GAS		SIGNIFICANT		3.15361	48.06897	NO					
25	GAS		MAJOR		8.4	200	NO					
26	OIL		SIGNIFICANT	798.40002	N/A	2.07E-02	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
27	OIL		MINOR	928.97699	3	1.9	NO					
28	OIL		SIGNIFICANT	1000	1	3.49	NO					
29	GAS		SIGNIFICANT		1	67	NO					
30	2-PHASE		SIGNIFICANT	799.12	1.7	74	NO					
31	CONDENSATE		MINOR	705	1	60	NO					
32	OIL		MINOR	996.90222	1	13	NO					
33	2-PHASE		SIGNIFICANT	843.07159	4.5	1.724138	NO					
34	GAS		MINOR		1	101.3793	NO					
35	OIL		MINOR	1000	1	4.1900001	NO					
36	GAS		MINOR		1	30.5	NO					
37	2-PHASE		SIGNIFICANT	799.12	1	6	NO					
38	GAS		MINOR		1	110	NO					
39	GAS		SIGNIFICANT		1	1.5	NO					
40	2-PHASE		MINOR	798.40002	1	80	NO					
41	GAS		MINOR		1	22	NO					
42	GAS		MINOR		8.266	1.00E-02	NO					
43	GAS		SIGNIFICANT		2	170	NO					
44	GAS		SIGNIFICANT		2.518	14	NO					
45	GAS		SIGNIFICANT		12.7	1.00E-02	NO					
46	NON-PROCESS	DIESEL	MINOR	798.40002	1	3.5	NO					
47	GAS		SIGNIFICANT		1.00679	152.60001	NO					
48	OIL		MINOR	996.90002	1	1	NO					
49	2-PHASE		SIGNIFICANT	798.40002	1	37.93	NO					
50	GAS		SIGNIFICANT		2	8.4799995	NO					
51	2-PHASE		MINOR	798.40002	1	110.34	NO					
52	GAS		MINOR		1	9.3000002	NO					
53	NON-PROCESS	DIESEL	MINOR	849.065	1.97199	4	NO					
54	NON-PROCESS	LUB OIL	MINOR	798.40002	2.116	1.00E-02	YES	DELAYED				1
55	NON-PROCESS	HYDRAULIC OIL	MINOR	798.40002	4	1.00E-02	YES	DELAYED	1			
56	GAS		SIGNIFICANT		37.3373	4	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL					
57	GAS	DIESEL LUB OIL	SIGNIFICANT	813.10461	11.616	41	NO	DELAYED	1								
58	GAS		MAJOR		3	90	NO										
59	OIL		SIGNIFICANT		1.98424	20.700001	NO										
60	CONDENSATE		MINOR		0.476	49.599998	NO										
61	NON-PROCESS		MINOR		1.393	8.2799997	NO										
62	NON-PROCESS		MINOR		N/A	83	YES										
63	GAS		SIGNIFICANT		1	29.5	NO										
64	GAS		MINOR		1.86377	33	NO										
65	CONDENSATE		MINOR		11.541	1	YES						IMMEDIATE				1
66	GAS		SIGNIFICANT		0.73	29	NO										
67	GAS	SIGNIFICANT	1.03724	20.799999	NO												
68	OIL	SIGNIFICANT	N/A	1.00E-02	NO												
69	GAS	SIGNIFICANT	1.82623	75	NO												
70	CONDENSATE	MINOR	0.0502029	19.310341	NO												
71	GAS	MINOR	1	8.2799997	NO												
72	OIL	MINOR	0.403933	0.5	NO												
73	OIL	SIGNIFICANT	2.31397	137.94	NO												
74	GAS	SIGNIFICANT	5.85386	213.8	NO												
75	CONDENSATE	MINOR	1	68	NO												
76	GAS	SIGNIFICANT	1	154	NO												
77	GAS	MINOR	1	30	NO												
78	GAS	SIGNIFICANT	1	125	NO												
79	GAS	SIGNIFICANT	0.895722	290	NO												
80	OIL	MINOR	0.748091	1	NO												
81	NON-PROCESS	LUB OIL	MINOR	798.40002	0.37627	2.5	YES	IMMEDIATE	1								
82	OIL		MINOR	818.35999	7.04	1.3	NO										
83	OIL		SIGNIFICANT	799.12	5.09236	18	NO										
84	OIL		MINOR	849.07001	3.8196	40	NO										
85	GAS		MINOR	0.56469	180	NO											
86	NON-PROCESS		SEAL OIL	SIGNIFICANT	798.40002	5.361	20						NO				

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
87	GAS	DIESEL	SIGNIFICANT		0.598343	146	NO	IMMEDIATE				
88	NON-PROCESS		MINOR	860	1.76443	3	YES				1	
89	OIL		MINOR	778.44	1	22	NO					
90	GAS		MINOR		1	130	NO					
91	GAS		SIGNIFICANT		4.48977	66	NO					
92	OIL		MINOR	839.07599	1	41	NO					
93	OIL		MINOR	799.12	2.944	15	NO					
94	GAS		SIGNIFICANT		0.563439	25	NO					
95	OIL		MINOR	799.12	1	5	NO					
96	2-PHASE		MINOR	799	0.516935	60	NO					
97	OIL		MINOR	789.13	0.341815	14.5	NO					
98	OIL		MINOR	855.05841	1.78749	28	NO					
99	GAS		SIGNIFICANT		8.267	50	NO					
100	OIL		MINOR	798.40002	2.22409	2	NO					
101	OIL		MINOR	938.96997	1	9	NO					
102	NON-PROCESS	HYDRAULIC OIL	SIGNIFICANT	799.12	6	414	NO					
103	2-PHASE		SIGNIFICANT	844.90002	0.54	97	NO					
104	GAS		SIGNIFICANT		43.18	58.630001	NO					
105	GAS		SIGNIFICANT		1	63.459999	NO					
106	GAS		SIGNIFICANT		9.49645	17.549999	NO					
107	GAS		MINOR		5.14918	0.5	NO					
108	GAS		SIGNIFICANT		1.01119	73	NO					
109	NON-PROCESS		MINOR	798.40002	2.05503	7	NO					
110	GAS		SIGNIFICANT		0.613163	100	NO					
111	GAS		SIGNIFICANT		2.63267	11.39	NO					
112	GAS	DIESEL	SIGNIFICANT		2.5	5.8699999	NO					
113	CONDENSATE		SIGNIFICANT	759.15997	8.01039	20	NO					
114	GAS		MINOR		1	17.25	NO					
115	GAS		MINOR		1	46.91	NO					
116	GAS		MINOR		1	150	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
117	GAS		MAJOR		7.60381	250	NO					
118	GAS		SIGNIFICANT		44.416	1.00E-02	NO					
119	GAS		SIGNIFICANT		1	200	NO					
120	2-PHASE		MINOR	799.12	0.449624	68.970001	NO					
121	GAS		MINOR		N/A	1.00E-02	YES	DELAYED	1			
122	NON-PROCESS	METHANOL	MINOR	798.40002	0.441638	820	NO					
123	GAS		MINOR		0.503774	47	NO					
124	OIL		MINOR	778.44	1.02061	28	NO					
125	GAS		SIGNIFICANT		10.8824	1	NO					
126	NON-PROCESS	LUB OIL	MINOR	798.40002	0.5	0.49000001	YES	DELAYED	1			
127	OIL		SIGNIFICANT	798.40002	20.0768	11	NO					
128	GAS		MINOR		1.24458	80	NO					
129	NON-PROCESS	DIESEL	MINOR	858.28003	4.13145	2.5	NO					
130	OIL		MINOR	840	0.160143	8	NO					
131	2-PHASE		SIGNIFICANT	798.40002	4.94815	16	NO					
132	CONDENSATE		MINOR	700	0.105861	16	NO					
133	OIL		MINOR	978.03998	0.5	1.3	NO					
134	OIL		MINOR	840	21.4189	1.00E-02	NO					
135	OIL		MINOR	768.46002	0.391535	14.5	NO					
136	OIL		MINOR	838.32001	0.563899	16	NO					
137	OIL		MINOR	818.35999	1	16	NO					
138	CONDENSATE		SIGNIFICANT	998.40002	7.97885	10	NO					
139	2-PHASE		MINOR	850	3.39666	0.1	NO					
140	GAS		SIGNIFICANT		4.92005	60	NO					
141	GAS		SIGNIFICANT		1	31.4	NO					
142	GAS		MINOR		0.619129	145	NO					
143	GAS		SIGNIFICANT		1.99278	70	NO					
144	GAS		MINOR		1	0.5	NO					
145	OIL		MINOR	864.27002	2	11.04	NO					
146	NON-PROCESS	DIESEL	SIGNIFICANT	798.40002	1.14696	120	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
147	GAS		SIGNIFICANT		5.337	3	NO					
148	GAS		SIGNIFICANT		1	59.700001	NO					
149	GAS		MINOR		19.05	0.30000001	NO					
150	2-PHASE		SIGNIFICANT	798.40002	1.07157	12.28	NO					
151	CONDENSATE		MINOR	698.59998	12	1.00E-02	NO					
152	OIL		SIGNIFICANT	798.40002	1.301	11	NO					
153	GAS		SIGNIFICANT		3.26942	161	NO					
154	GAS		SIGNIFICANT		0.727828	170	NO					
155	OIL		SIGNIFICANT	866	5.8282	11.73	NO					
156	NON-PROCESS	DIESEL	MINOR	798.40002	0.594935	2.5	NO					
157	GAS		MINOR		0.133085	60	NO					
158	NON-PROCESS	DIESEL	MINOR	819.09802	1.56127	12	NO					
159	GAS		SIGNIFICANT		0.632786	130	NO					
160	NON-PROCESS	METHANOL	SIGNIFICANT	798.40002	5.812	28	NO					
161	GAS		SIGNIFICANT		1	150	NO					
162	GAS		MINOR		1.75199	2.7	NO					
163	GAS		SIGNIFICANT		1.27532	67.800003	NO					
164	GAS		SIGNIFICANT		1	70	NO					
165	OIL		SIGNIFICANT	798.40002	7.57786	17	NO					
166	GAS		MINOR		0.420707	40	NO					
167	OIL		MINOR	828.34003	2.258	5	NO					
168	NON-PROCESS	LUB OIL	MINOR	798.40002	0.847185	3.8	YES	IMMEDIATE	1			
169	OIL		MINOR	798.40002	1.99957	24	NO					
170	2-PHASE		SIGNIFICANT	798.40002	2.19415	108	NO					
171	GAS		MINOR		2.28643	7	NO					
172	GAS		SIGNIFICANT		N/A	510.35001	NO					
173	NON-PROCESS	OIL BASED MUD	SIGNIFICANT	798.40002	N/A	51.400002	NO					
174	GAS		SIGNIFICANT		3.45856	98	NO					
175	CONDENSATE		MINOR	598.79999	0.601037	5	NO					
176	OIL		SIGNIFICANT	832.33002	3.729	60.700001	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL		
177	GAS	LUB OIL	MINOR	820	0.352831	158	NO	DELAYED	1					
178	OIL		MINOR		0.403494	0.69999999	NO							
179	GAS		SIGNIFICANT		10.5721	21	NO							
180	NON-PROCESS		MINOR		798.40002	0.5	0.49000001						YES	
181	GAS		SIGNIFICANT		0.825927	62.080002	NO							
182	GAS			SIGNIFICANT	598.79999	N/A	1.00E-02	YES	IMMEDIATE	1				
183	CONDENSATE			MINOR		0.401938	25	NO						
184	GAS			MAJOR		3	200	NO						
185	2-PHASE			SIGNIFICANT		798.40002	1.03202	11						NO
186	GAS			MINOR		5	8	NO						
187	NON-PROCESS	DIESEL		MINOR	798.40002	1.20057	60	NO						
188	GAS	SIGNIFICANT		1.83743	4.1500001	NO								
189	CONDENSATE	MINOR		598.79999	0.1	94	NO							
190	CONDENSATE	MINOR		598.79999	0.267435	10	NO							
191	GAS	SIGNIFICANT		0.881562	137.94	NO								
192	OIL	MINOR	798.40002	4.17919	14	NO								
193	GAS	SIGNIFICANT	5.00932	4	NO									
194	OIL	SIGNIFICANT	798.40002	29.7467	10	NO								
195	OIL	MINOR	780	1.09595	8	NO								
196	NON-PROCESS	DIESEL	MINOR	848.29999	2.35483	17.25	NO							
197	GAS	SIGNIFICANT	2.3497	100	NO									
198	GAS	SIGNIFICANT	3	75.860001	NO									
199	OIL	SIGNIFICANT	790.12988	5.79145	0.5	NO								
200	GAS	SIGNIFICANT	2.266	13.7931	NO									
201	OIL	MINOR	799.12	4.36375	8.6206894	NO								
202	NON-PROCESS	GLYCOL	MINOR	1197.6	0.453	3.5	NO							
203	GAS	MINOR	0.25	38.700001	NO									
204	GAS	SIGNIFICANT	3	161	NO									
205	GAS	MINOR	0.247544	90	NO									
206	GAS	SIGNIFICANT	1.52925	300	NO									

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
207	GAS	LUB OIL	MINOR		N/A	1.00E-02	NO					
208	GAS		MINOR		9.91823	0.22	NO					
209	GAS		SIGNIFICANT		1	35	NO					
210	GAS		MINOR		1.01058	8	NO					
211	OIL		SIGNIFICANT	798.40002	7.68453	1.00E-02	NO					
212	GAS		SIGNIFICANT		1	4.1999998	NO					
213	OIL		MINOR	798.40002	2	0.69999999	NO					
214	GAS		SIGNIFICANT		1	144	NO					
215	GAS		MINOR		0.97561	6	NO					
216	GAS		SIGNIFICANT		1	144	NO					
217	GAS		MINOR		1.51037	10	NO					
218	GAS		MINOR		1.051	20.700001	NO					
219	NON-PROCESS		MINOR	798.40002	2.05	1.75	YES	IMMEDIATE	1			
220	CONDENSATE		MINOR	678.64001	0.420367	11.8	NO					
221	2-PHASE		MINOR	798.40002	2.9149	13.8	NO					
222	CONDENSATE		MINOR	628.73999	1.96721	4.1500001	NO					
223	OIL		SIGNIFICANT	798.40002	25.8144	10.7	NO					
224	GAS		SIGNIFICANT		3.52941	35	NO					
225	GAS		SIGNIFICANT		11.5941	1.00E-02	NO					
226	CONDENSATE		MINOR	598.79999	3.0078	70	NO					
227	2-PHASE		MINOR	822.09003	0.16413	380	NO					
228	GAS		SIGNIFICANT		8.64909	67	NO					
229	GAS		SIGNIFICANT		2.11805	160	NO					
230	GAS		MINOR		0.417443	4	NO					
231	GAS		SIGNIFICANT		3.22107	4	NO					
232	OIL	DIESEL	MINOR	830	0.0133943	6.5	NO					
233	GAS		MINOR		0.557655	9.00E-02	NO					
234	NON-PROCESS		MINOR	798.40002	23.633	1.00E-02	NO					
235	GAS		SIGNIFICANT		1.18879	91.040001	NO					
236	OIL		MINOR	790.09998	6.37182	12	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
237	OIL		MINOR	798.40002	0.276046	8.6300001	NO					
238	OIL		MINOR	798.40002	3	35	NO					
239	GAS		MINOR		N/A	358.63	NO					
240	NON-PROCESS	DIESEL	SIGNIFICANT	798.40002	4.63855	17.25	NO					
241	OIL		MINOR	798.40002	5.3506	8.6300001	NO					

Table A.4. -Analysis of offshore data from 2001-2002

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1	1.265607327	0.008	0.017	0.002649586	5.684031606	0.674763764	0.080447388	0	0
2	12.07856716							1	0
3								0	0
4	166.1853764							1	0
5								0	0
6	84.12224895							1	0
7								0	0
8	1.266177847							1	0
9	1.266177847							0	0
10		0.008	0.017	0.000932439	5.955799245	0.26086416	0.031101018	0	0
11	12.6560734							1	0
12	84.65422884							1	0
13	87.9354508							1	0
14	25.18639012							1	0
15								0	0
16	10.59360394							1	0
17	34.67570878							1	0
18	49.84947219							1	0
19		0.008	0.017	0.002227701	16.3179806	0.576248121	0.068702053	0	0
20	149.8161848							1	0
21								0	0
22								0	0
23								0	0
24								0	0
25								0	0
26	1.821257707							0	0
27	16.18002941							1	0
28	21.1357517							1	0
29								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
30	108.87166							1	0
31	104.3724917	0.000248	0.01843	2.82689E-05	1.404469774	0.010833054	0.00129155	1	0
32	12.91963902	0.008	0.017	0.001041456	6.079830126	0.288478115	0.034393238	1	0
33	16.17926429							1	0
34								0	0
35	23.158584	0.008	0.017	0.001043072	10.89815718	0.288885641	0.034441825	1	0
36								0	0
37	31.00092197							1	0
38								0	0
39								0	0
40	113.2503906							1	0
41								0	0
42								0	0
43								0	0
44								0	0
45								0	0
46	23.68801871	0.0232	0.024	0.00321147	22.89841809	0.803822825	0.095834202	1	0
47								0	0
48	11.33128551	0.008	0.017	0.001041454	5.332369652	0.288477825	0.034393204	1	0
49	77.98052174							1	0
50								0	0
51	133.002929							1	0
52								0	0
53	24.55638937	0.0232	0.024	0.00465068	23.73784306	1.125899843	0.134233203	1	0
54	1.266177847	0.00714	0.03	0.001607411	0.301350328	0.42818882	0.051049973	1	1
55	1.266177847	0.00714	0.03	0.002210035	0.301350328	0.572088204	0.068206095	1	1
56								0	0
57								0	0
58								0	0
59	57.08433634	0.008	0.017	0.001324905	26.8632171	0.359126902	0.042816201	1	0
60	113.1370827	0.000248	0.01843	1.63591E-05	1.522408926	0.00658537	0.000785128	1	0
61	36.43425351	0.0232	0.024	0.003790351	35.21977839	0.934669546	0.111434145	1	0
62	115.3542929	0.00714	0.03					0	1

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
63								0	0
64								0	0
65	12.6617786	0.000248	0.01843	0.000102199	0.17038096	0.034886386	0.004159261	1	1
66								0	0
67								0	0
68	1.266177847	0.008	0.017					0	0
69								0	0
70	64.24791882	0.000248	0.01843	5.8374E-06	0.864540633	0.002578218	0.000307383	1	0
71								0	0
72	8.68590862	0.008	0.017	0.000610582	4.087486409	0.177454374	0.02115665	1	0
73	146.8189648	0.008	0.017	0.001436023	69.09127755	0.386435079	0.046071965	1	0
74								0	0
75	120.56425	0.000248	0.01843	2.60529E-05	1.622351276	0.010057455	0.00119908	1	0
76								0	0
77								0	0
78								0	0
79								0	0
80	12.6617786	0.008	0.017	0.000806124	5.958484046	0.228499664	0.027242425	1	0
81	20.0200298	0.00714	0.03	0.000677827	4.764767092	0.195154249	0.023266883	1	1
82	14.25950556	0.008	0.017	0.002503646	6.710355556	0.640857117	0.076404934	1	0
83	53.69517193	0.008	0.017	0.002104166	25.2683162	0.547094823	0.065226308	1	0
84	77.65389243	0.008	0.017	0.001878431	36.5430082	0.493416179	0.058826577	1	0
85								0	0
86	56.62519532	0.00714	0.03	0.002558539	13.47679649	0.653630846	0.077927857	1	0
87								0	0
88	21.13082175	0.0232	0.024	0.004427362	20.42646103	1.076593619	0.128354765	1	1
89	60.14558498	0.008	0.017	0.000920295	28.3038047	0.257770608	0.030732196	1	0
90								0	0
91								0	0
92	79.08539101	0.008	0.017	0.000955466	37.21665459	0.266719976	0.031799167	1	0
93	49.01676149	0.008	0.017	0.001599887	23.06671129	0.426364578	0.050832482	1	0
94								0	0
95	28.29984044	0.008	0.017	0.000932439	13.31757197	0.26086416	0.031101018	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
96	98.04088442							1	0
97	48.49698154	0.008	0.017	0.000541732	22.82210896	0.15914885	0.01897421	1	0
98	64.74199965	0.008	0.017	0.001289538	30.46682336	0.350392566	0.041774867	1	0
99								0	0
100	17.90645902	0.008	0.017	0.001389955	8.426568949	0.375137624	0.044725048	1	0
101	35.02679399	0.008	0.017	0.001010742	16.48319717	0.280725898	0.033468995	1	0
102	257.5129982	0.00714	0.03	0.002707949	61.28809357	0.688276007	0.082058358	1	0
103	121.2238832							1	0
104								0	0
105								0	0
106								0	0
107								0	0
108								0	0
109	33.49991733	0.0232	0.024	0.004603763	32.38325342	1.115559143	0.133000353	1	0
110								0	0
111								0	0
112								0	0
113	58.07020145	0.000248	0.01843	8.30248E-05	0.781411284	0.028876126	0.0034427	1	0
114								0	0
115								0	0
116								0	0
117								0	0
118								0	0
119								0	0
120	105.1063854							1	0
121								0	1
122	362.5781606	5.44E-04	0.0226	4.8562E-05	8.727545105	0.017725142	0.002113245	1	0
123								0	0
124	67.85337099	0.008	0.017	0.00092973	31.93099811	0.260174431	0.031018787	1	0
125								0	0
126	8.863245109	0.00714	0.03	0.000781365	2.109452336	0.222104342	0.026479955	1	1
127	41.99436879	0.008	0.017	0.00417611	19.7620559	1.02085085	0.121708943	1	0
128								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
129	19.30903125	0.0232	0.024	0.006767985	18.66539687	1.584082607	0.188859145	1	0
130	34.91486244	0.008	0.017	0.000382567	16.4305235	0.115964258	0.013825611	1	0
131	50.64711439							1	0
132	54.0898723	0.000248	0.01843	9.16498E-06	0.727850696	0.003886864	0.000463404	1	0
133	13.04362657	0.008	0.017	0.00072942	6.138177212	0.208626544	0.024873091	1	0
134	1.234426787	0.008	0.017	0.004424383	0.580906723	1.075934267	0.128276155	1	0
135	49.14488771	0.008	0.017	0.000572151	23.12700598	0.167260833	0.019941345	1	0
136	49.42652295	0.008	0.017	0.000717167	23.25954021	0.205434808	0.024492563	1	0
137	50.0256548	0.008	0.017	0.000943597	23.54148461	0.263703353	0.031439516	1	0
138	35.80574334	0.000248	0.01843	9.50248E-05	0.481813584	0.032650609	0.003892705	1	0
139	3.880570001							1	0
140								0	0
141								0	0
142								0	0
143								0	0
144								0	0
145	40.43568432	0.008	0.017	0.001371369	19.02855733	0.370569867	0.044180466	1	0
146	138.7028351	0.0232	0.024	0.003439363	134.0794073	0.855568523	0.102003481	1	0
147								0	0
148								0	0
149								0	0
150	44.37045668							1	0
151	1.353601092	0.000248	0.01843	9.74808E-05	0.018214491	0.033417683	0.003984158	1	0
152	41.99436879	0.008	0.017	0.001063074	19.7620559	0.293922255	0.035042305	1	0
153								0	0
154								0	0
155	41.63849702	0.008	0.017	0.002343369	19.59458683	0.603413148	0.07194075	1	0
156	20.0200298	0.0232	0.024	0.002477072	19.35269547	0.634664148	0.07566659	1	0
157								0	0
158	43.30396567	0.0232	0.024	0.004064438	41.86050015	0.995979293	0.11874368	1	0
159								0	0
160	66.99983465	5.44E-04	0.0226	0.000176168	1.612739383	0.057260171	0.006826732	1	0
161								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
162								0	0
163								0	0
164								0	0
165	52.20585057	0.008	0.017	0.002565654	24.56745909	0.655284648	0.078125028	1	0
166								0	0
167	27.796215	0.008	0.017	0.001426529	13.08057177	0.384109707	0.045794727	1	0
168	24.68235041	0.00714	0.03	0.001017087	5.874399397	0.282329204	0.033660146	1	1
169	62.0297936	0.008	0.017	0.001317932	29.19049111	0.35740651	0.042611091	1	0
170	131.5850631							1	0
171								0	0
172								0	0
173	90.77709555							0	0
174								0	0
175	32.69257244	0.000248	0.01843	2.01979E-05	0.439921756	0.007977892	0.000951148	1	0
176	96.61655645	0.008	0.017	0.001837631	45.4666148	0.483654206	0.057662725	1	0
177								0	0
178	10.45314743	0.008	0.017	0.000599984	4.919128201	0.174649413	0.020822234	1	0
179								0	0
180	8.863245109	0.00714	0.03	0.000781365	2.109452336	0.222104342	0.026479955	1	1
181								0	0
182								0	1
183	73.10281435	0.000248	0.01843	1.65171E-05	0.983694952	0.006643248	0.000792028	1	0
184								0	0
185	41.99436879							1	0
186								0	0
187	98.07771529	0.0232	0.024	0.003518825	94.80845811	0.873537676	0.104145818	1	0
188								0	0
189	141.7516163	0.000248	0.01843	8.23863E-06	1.907455281	0.003527671	0.00042058	1	0
190	46.23427934	0.000248	0.01843	1.3473E-05	0.622143314	0.005519152	0.00065801	1	0
191								0	0
192	47.37603742	0.008	0.017	0.001905332	22.29460585	0.499842538	0.059592747	1	0
193								0	0
194	40.0400596	0.008	0.017	0.005083281	18.84238099	1.220818077	0.145549644	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
195	36.23286509	0.008	0.017	0.0009644	17.05076004	0.268988545	0.032069632	1	0
196	51.01816142	0.0232	0.024	0.005079818	49.31755604	1.220061138	0.145459399	1	0
197								0	0
198								0	0
199	8.999963418	0.008	0.017	0.002231297	4.235276903	0.577094576	0.06880297	1	0
200								0	0
201	37.15951044	0.008	0.017	0.001947827	17.48682844	0.509977073	0.060801017	1	0
202	19.34118653	0.02	0.045	0.003124937	8.596082902	0.784088967	0.093481471	1	0
203								0	0
204								0	0
205								0	0
206								0	0
207								0	0
208								0	0
209								0	0
210								0	0
211	1.266177847	0.008	0.017	0.002583648	0.595848399	0.659465646	0.0786235	1	0
212								0	0
213	10.59360394	0.008	0.017	0.001318074	4.985225385	0.357441479	0.04261526	1	0
214								0	0
215								0	0
216								0	0
217								0	0
218								0	0
219	16.74995866	0.00714	0.03	0.001582144	3.986490162	0.422059523	0.05031922	1	1
220	47.17655873	0.000248	0.01843	1.79824E-05	0.634822928	0.007177477	0.000855721	1	0
221	47.03641987							1	0
222	29.06655063	0.000248	0.01843	3.74434E-05	0.391128842	0.013990437	0.001667982	1	0
223	41.4177597	0.008	0.017	0.00473539	19.49071045	1.144546724	0.136456341	1	0
224								0	0
225								0	0
226	122.3244052	0.000248	0.01843	4.51835E-05	1.646036489	0.01659936	0.001979026	1	0
227	243.2411749							1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
228								0	0
229								0	0
230								0	0
231								0	0
232	31.66085341	0.008	0.017	0.00010998	14.89922513	0.037295385	0.004446469	1	0
233								0	0
234	1.266177847	0.0232	0.024	0.015612171	1.223971919	3.389310939	0.404083957	1	0
235								0	0
236	44.09147042	0.008	0.017	0.002340385	20.74892725	0.602713862	0.071857379	1	0
237	37.19633202	0.008	0.017	0.000489683	17.50415624	0.145172001	0.017307847	1	0
238	74.90809238	0.008	0.017	0.001614304	35.250867	0.429859443	0.05124915	1	0
239								0	0
240	52.58831612	0.0232	0.024	0.006916637	50.83537225	1.615713131	0.192630233	1	0
241	37.19633202	0.008	0.017	0.002155887	17.50415624	0.559318818	0.06668369	1	0

Table A.5. - Offshore data from 2002-2003

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
1	GAS		SIGNIFICANT		2	41.389999	NO					
2	NON-PROCESS	METHANOL	MINOR	799.12	1.85094	220	NO					
3	2-PHASE		SIGNIFICANT	838.84003	9.83698	4.5	NO					
4	GAS		MINOR		5.11961	3.448276	NO					
5	2-PHASE		MINOR	600	1.47015	7.5999999	NO					
6	OIL		MINOR	799.12	5.2898	2	NO					
7	GAS		SIGNIFICANT		4.93926	3	NO					
8	GAS		MINOR		0.457843	17	NO					
9	OIL		MINOR	839.08002	0.802165	18.01	YES	DELAYED	1		2	
10	GAS		MINOR		1.74291	15.1	NO					
11	OIL		MINOR	786	0.700597	12	NO					
12	GAS		MINOR		8.38762	1.00E-02	NO					
13	NON-PROCESS	DIESEL	MINOR	849.065	3.96232	34.48	NO					
14	GAS		MINOR		0.678728	85	NO					
15	GAS		SIGNIFICANT		1.47933	117	NO					
16	GAS		MINOR		1.4	3.2	NO					
17	2-PHASE		MINOR	799.12	0.470588	8.5600004	NO					
18	GAS		MINOR		0.25	380	NO					
19	GAS		SIGNIFICANT		1.05109	172	NO					
20	GAS		SIGNIFICANT		7.53456	1	NO					
21	NON-PROCESS	HELIFUEL	MINOR	799.12	2.92993	1.7	NO					
22	OIL		MINOR	799.12	1	7	NO					
23	OIL		MINOR	831	0.445263	3	NO					
24	NON-PROCESS	METHANOL	MINOR	799.12	3.43585	1.00E-02	NO					
25	GAS		MINOR		0.751774	73	NO					
26	GAS		SIGNIFICANT		0.875669	200	NO					
27	GAS		SIGNIFICANT		4.82022	74	NO					
28	GAS		SIGNIFICANT		1.81272	160	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
29	GAS	METHANOL	SIGNIFICANT		15.3391	1	NO	IMMEDIATE				
30	NON-PROCESS		SIGNIFICANT	799.12	1.31	170	NO					
31	CONDENSATE		MINOR	598.79999	1.40852	5.5	NO					
32	OIL		SIGNIFICANT	799.12	9.1622	25	NO					
33	OIL		SIGNIFICANT	794.12	94.181	1.00E-02	NO					
34	OIL		SIGNIFICANT	817.70001	13.4017	0.80000001	NO					
35	GAS		MINOR		0.113	160	NO					
36	OIL		MINOR	809.10999	8.21703	1.00E-02	NO					
37	GAS		SIGNIFICANT		39.5893	0.69	NO					
38	OIL		MINOR	699.22998	1	4.1999998	NO					
39	GAS		SIGNIFICANT		0.151749	114	NO					
40	OIL		MINOR	798.40002	0.669113	25	NO					
41	GAS		SIGNIFICANT		25.4	5.00E-02	NO					
42	NON-PROCESS	DIESEL	MINOR	799.12	1.03687	100	NO					
43	OIL		MINOR	808.38	1.07089	27	NO					
44	OIL		MINOR	798.40002	3.32004	14.5	NO					
45	GAS		MINOR		0.35439	110	NO					
46	CONDENSATE		MINOR	699.22998	5.13631	7	NO					
47	OIL		MINOR	832.08002	0.135771	18	YES				1	
48	GAS		SIGNIFICANT		11.7647	1	NO					
49	GAS		SIGNIFICANT		1.27624	185	NO					
50	CONDENSATE		MINOR	552.12	1.81552	14.14	NO					
51	OIL		SIGNIFICANT	799.12	0.723279	110	NO					
52	GAS		MINOR		0.29376	50.700001	NO					
53	GAS		MINOR		0.200774	0.22	NO					
54	OIL		MINOR	778.44	6.84773	20	NO					
55	GAS		MINOR		0.846344	9	NO					
56	2-PHASE		SIGNIFICANT	864.27002	0.25	10.35	NO					
57	GAS		MINOR		6.36267	1.00E-02	NO					
58	GAS		SIGNIFICANT		0.5	128	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
59	GAS	FUEL OIL	SIGNIFICANT	799.12	3.25185	6.9099998	NO	IMMEDIATE				
60	GAS		SIGNIFICANT		0.88759	100	NO					
61	GAS		MINOR		N/A	1.6	NO					
62	GAS		SIGNIFICANT		1	172.42	NO					
63	GAS		MINOR		1.02573	65.25	NO					
64	GAS		SIGNIFICANT		0.641368	147	NO					
65	NON-PROCESS		SIGNIFICANT		33.799	6	NO					
66	CONDENSATE	LUB OIL	MINOR	749.17499	25.5	1.00E-02	NO					
67	GAS		MINOR	799.12	0.982	20.703449	NO					
68	GAS		MINOR		0.492	96.565514	NO					
69	NON-PROCESS		MINOR		1	5	YES				1	
70	CONDENSATE		MINOR		6.54545	4.5	NO					
71	GAS		MINOR		0.225644	170	NO					
72	GAS		SIGNIFICANT		0.25	310	NO					
73	GAS		MAJOR		4.80423	120.6897	NO					
74	GAS		MAJOR		69.996	79	NO					
75	GAS		MAJOR		25.4	5.5	NO					
76	GAS		MAJOR		44.4742	0.12	NO					
77	GAS		MINOR		3	5	NO					
78	GAS		MINOR		0.585441	180	NO					
79	OIL		SIGNIFICANT	866.04999	40.3676	1.00E-02	NO					
80	GAS		MINOR	838.32001	0.314769	25	NO					
81	OIL		MINOR		0.444322	5.4000001	NO					
82	GAS		SIGNIFICANT		3.33275	320	NO					
83	GAS		SIGNIFICANT		13.9672	35	NO					
84	GAS		MINOR		2.3497	1.00E-02	NO					
85	OIL	DIESEL	MINOR	973.92749	0.591334	7	NO					
86	NON-PROCESS		MINOR	798.40002	0.937288	18	NO					
87	GAS		MINOR		4.3562	2	NO					
88	GAS		MINOR		0.834887	4	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
89	OIL	LUB OIL	MINOR	799.12	1.29215	179.31	NO					
90	GAS		MINOR		4.5	46	NO					
91	GAS		SIGNIFICANT		0.760174	30	NO					
92	NON-PROCESS		MINOR	799.12	0.26411	3.52	NO					
93	GAS		SIGNIFICANT		5.14911	24.799999	NO					
94	GAS		MINOR		0.198684	143	NO					
95	2-PHASE		MINOR	811.10681	0.636216	551.72412	NO					
96	GAS	OIL BASED MUD	MINOR		0.156155	40	NO					
97	OIL		MINOR	799.12	0.436041	138.62	NO					
98	GAS		MINOR		0.5	97.931038	NO					
99	NON-PROCESS		MINOR	998	1	4.1500001	NO					
100	CONDENSATE		MINOR	720	1	7	NO					
101	GAS		SIGNIFICANT		19.8839	8.00E-02	NO					
102	GAS		MINOR		0.19973	60	NO					
103	GAS		MINOR		0.19973	63	NO					
104	GAS		MAJOR		44.1426	0.12	NO					
105	GAS		MINOR		0.948367	30	NO					
106	NON-PROCESS	DIESEL	MINOR	798.40002	6.10202	4	NO					
107	GAS		SIGNIFICANT		0.376125	140.89999	NO					
108	GAS		MINOR		4.30065	1.00E-02	NO					
109	GAS		SIGNIFICANT		12.7	4	NO					
110	GAS		MINOR		0.2	20	NO					
111	OIL		SIGNIFICANT	798.40997	1.86056	6	NO					
112	GAS		MINOR		0.1	115	NO					
113	GAS	LUB OIL	MINOR		5.75	0.14	NO					
114	GAS		MINOR		1.2	9.6700001	NO					
115	OIL		SIGNIFICANT	794.12549	4.59871	40	NO					
116	OIL		SIGNIFICANT	830	4.42994	15	NO					
117	NON-PROCESS		MINOR	799.12	1.60775	3	YES	DELAYED	1			
118	GAS		SIGNIFICANT		1	50	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL		
119	GAS		SIGNIFICANT	649.28497	0.349793	178	NO							
120	CONDENSATE		MINOR		0.169	5.5	NO							
121	GAS		MINOR		0.1	130	NO							
122	OIL		MINOR		0.025	2.8	NO							
123	GAS		MINOR		0.676806	11.6	NO							
124	GAS		MINOR		0.978345	13.8	NO							
125	GAS		MINOR		2	3.0999999	NO							
126	2-PHASE		MINOR		973.92999	0.195478	11						NO	
127	NON-PROCESS		OIL BASED MUD		SIGNIFICANT	798.40002	1.88278						279.32001	NO
128	NON-PROCESS		GLYCOL		MINOR	799.12	5.23049						13.8	NO
129	NON-PROCESS	BOTTLED GAS	MINOR	1.5599999	4.63193	0.49000001	YES	IMMEDIATE	1					
130	CONDENSATE		MINOR	743	0.31437	78	NO							
131	CONDENSATE		MINOR	699.22998	0.944945	11	NO							
132	GAS		MINOR	0.169039	160	NO								
133	GAS		SIGNIFICANT	1.245	71	NO								
134	GAS		MINOR	0.254	55.186211	NO								
135	NON-PROCESS		OIL BASED MUD	MINOR	948.95001	25.4	1						NO	
136	GAS		MINOR	2.184	0.60000002	NO								
137	GAS		SIGNIFICANT	3.18	305	NO								
138	OIL		MINOR	835	3.90275	1.00E-02	NO							
139	NON-PROCESS		METHANOL	MINOR	798.40002	2	35						NO	
140	GAS		MINOR	716	2.6	34.48	NO							
141	GAS		MINOR		0.5	178	NO							
142	CONDENSATE		MINOR		1.04154	35	NO							
143	GAS		MINOR		0.1	130	NO							
144	OIL		MINOR		978.91998	3.08637	12						NO	
145	GAS		MINOR		0.160155	108.6	NO							
146	OIL		MINOR		798.40002	5.13374	0.02						NO	
147	GAS		SIGNIFICANT		1.45924	77	NO							
148	GAS		SIGNIFICANT		6.37753	250	NO							

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
149	GAS		MINOR		0.0946494	53.799999	NO					
150	OIL		MINOR	815	0.946508	10	NO					
151	OIL		MINOR	798.40002	6.37604	4.1500001	NO					
152	OIL		SIGNIFICANT	798.40002	6.16337	3.46	NO					
153	CONDENSATE		SIGNIFICANT	700	3	1.04	NO					
154	GAS		SIGNIFICANT		0.101	130.8	NO					
155	2-PHASE		SIGNIFICANT	799.12	0.189109	14.5	NO					
156	GAS		MAJOR		75.6258	38	NO					
157	GAS		MINOR		0.0253128	118	NO					
158	GAS		MINOR		3.73231	4.8400002	NO					
159	GAS		MINOR		0.463112	5.5	NO					
160	OIL		SIGNIFICANT	798.40002	0.991012	10	NO					
161	GAS		MINOR		1.56811	10	NO					
162	GAS		MINOR		0.883961	120	NO					
163	GAS		MINOR		0.55893	87	NO					
164	CONDENSATE	METHANOL	SIGNIFICANT	777.23999	0.280164	240	NO					
165	GAS		SIGNIFICANT		1.90877	125	NO					
166	NON-PROCESS		SIGNIFICANT	798.40002	3.55317	475	NO					
167	GAS		SIGNIFICANT		7.44019	350	NO					
168	GAS		SIGNIFICANT		1.33333	117.25	NO					
169	GAS		SIGNIFICANT		3.86332	20.700001	NO					
170	GAS		MINOR		0.447235	45	NO					
171	NON-PROCESS		MINOR	849.06	3.31013	6.9099998	NO					
172	OIL		MINOR	799.12	1	0.5	NO					
173	OIL		SIGNIFICANT	798.40002	3.97161	93.110001	NO					
174	OIL		MINOR	798.40002	1.49618	1	NO					
175	CONDENSATE		MINOR	598.79999	3.59504	1.00E-02	NO					
176	CONDENSATE		MINOR	664.09998	0.520471	26	NO					
177	2-PHASE		MINOR	888.21997	0.24	27	NO					
178	GAS	DIESEL	MINOR		0.263167	146	NO					
179	GAS		MINOR		1	31.549999	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
180	GAS		MINOR		0.304346	148	NO					
181	GAS		MINOR		1	130	NO					
182	GAS		MINOR		1.93734	12	NO					
183	OIL		MINOR	831	1	3.2	NO					
184	2-PHASE		SIGNIFICANT	799.12	0.525	66	NO					
185	GAS		SIGNIFICANT		1.479	40	NO					
186	OIL		SIGNIFICANT	758.28998	2.59563	20	NO					
187	GAS		MINOR		2	71	NO					
188	OIL		MINOR	848.40002	4.51424	0.5	NO					
189	CONDENSATE		MINOR	724.20001	0.710875	75.870003	YES					
190	GAS	DIESEL	MINOR		0.363	189.3241	NO	IMMEDIATE	1		2	3
191	NON-PROCESS		MINOR	830.336	1.152	18	NO					
192	OIL		SIGNIFICANT	798.40002	9.02643	19	NO					
193	GAS		SIGNIFICANT		0.388145	13	NO					
194	OIL		SIGNIFICANT	798.40002	0.997484	13	NO					
195	OIL		SIGNIFICANT	778.44	6.35	3	NO					
196	OIL		SIGNIFICANT	798.40002	2.09013	10	NO					
197	OIL		MINOR	799.12	1.8872	0.5	NO					
198	NON-PROCESS		SIGNIFICANT	886.02002	11.9671	1.73	NO					
199	OIL		MINOR	799.12	1	8	NO					
200	GAS	DIESEL HELIFUEL	MINOR		0.567299	12	NO					
201	CONDENSATE		MINOR	599.34003	0.854784	11	NO					
202	NON-PROCESS		MINOR	799.12	0.232072	68.970001	NO					
203	NON-PROCESS		MINOR	799.12	1.49618	1	NO					
204	GAS		MINOR		1.87699	10.35	NO					
205	OIL		MINOR	819.09998	2.74688	9	NO					
206	GAS		MINOR		5.46223	0	NO					
207	GAS		MINOR		0.190005	140	NO					
208	GAS		MINOR		1	5	NO					
209	GAS		MINOR		0.237604	227.60001	NO					
210	CONDENSATE		MINOR	800	0.35375	80	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
211	OIL	LUB OIL	MINOR	798.40002	0.319	6	NO	IMMEDIATE				
212	GAS		MINOR		2	4.2800002	NO					
213	2-PHASE		SIGNIFICANT	798.40002	8	75	NO					
214	GAS		SIGNIFICANT		0.5	180	NO					
215	GAS		SIGNIFICANT		6	0.5	NO					
216	NON-PROCESS		SIGNIFICANT	906	10.8411	1.00E-02	NO					
217	GAS		SIGNIFICANT		1.33202	32	NO					
218	2-PHASE		SIGNIFICANT	865.27002	1	13	NO					
219	GAS		SIGNIFICANT		0.414858	116	NO					
220	GAS		SIGNIFICANT		3.5	39	NO					
221	OIL	METHANOL	SIGNIFICANT	787.41998	5.14737	35	NO	IMMEDIATE		1		
222	GAS		SIGNIFICANT		10.1322	110.35	NO					
223	GAS		MINOR		N/A	1.98	YES					
224	GAS		MINOR		3.453	194.1172	NO					
225	2-PHASE		MINOR	973.92999	0.473001	11	NO					
226	NON-PROCESS		SIGNIFICANT	799.12	2	50	NO					
227	GAS		MINOR		0.731392	42	NO					
228	OIL		SIGNIFICANT	899.01001	5.03538	14	NO					
229	OIL		MINOR	819.09998	1	7	NO					
230	OIL		MAJOR	835	3.51	42	NO					

Table A.6. - Analysis of offshore data from 2002-2003

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1								0	0
2	187.7199047	5.44E-04	0.0226	9.94616E-05	4.518567619	0.034035029	0.00405776	1	0
3	26.20424602							1	0
4								0	0
5	40.26578339							1	0
6	17.89839064	0.008	0.017	0.002144569	8.422772068	0.556646234	0.066365057	1	0
7								0	0
8								0	0
9	52.41555049	0.008	0.017	0.000855752	24.66614141	0.241266198	0.02876449	1	1
10								0	0
11	44.20631712	0.008	0.017	0.000774034	20.80297276	0.22020708	0.026253758	1	0
12								0	0
13	72.09715773	0.0232	0.024	0.006592329	69.69391914	1.546625477	0.184393392	1	0
14								0	0
15								0	0
16								0	0
17	37.02847935							1	0
18								0	0
19								0	0
20								0	0
21	16.50150083	0.0016	0.026	0.000394767	1.015476974	0.119324706	0.014226254	1	0
22	33.48482278	0.008	0.017	0.000932439	15.75756366	0.26086416	0.031101018	1	0
23	21.4963686	0.008	0.017	0.000634488	10.11593816	0.183765922	0.021909132	1	0
24	1.265607327	5.44E-04	0.0226	0.000135512	0.030464176	0.045098092	0.005376732	1	0
25								0	0
26								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
27								0	0
28								0	0
29								0	0
30	165.0150083	5.44E-04	0.0226	8.36748E-05	3.972042676	0.029081784	0.003467219	1	0
31	34.28825925	0.000248	0.01843	3.09198E-05	0.46139383	0.011753718	0.001401314	1	0
32	63.28036698	0.008	0.017	0.002822411	29.77899623	0.714700868	0.085208811	1	0
33	1.269585383	0.008	0.017	0.009020678	0.597451945	2.057441267	0.245294404	1	0
34	11.19058987	0.008	0.017	0.003452959	5.266159941	0.858645656	0.102370346	1	0
35								0	0
36	1.257769904	0.008	0.017	0.002689525	0.59189172	0.684013485	0.081550168	1	0
37								0	0
38	27.72806729	0.008	0.017	0.000872217	13.04850225	0.24548676	0.029267678	1	0
39								0	0
40	63.30889299	0.008	0.017	0.000762385	29.79242023	0.217189366	0.025893977	1	0
41								0	0
42	126.560734	0.0232	0.024	0.003271612	122.3420428	0.817509879	0.097466014	1	0
43	65.38514434	0.008	0.017	0.000970498	30.76947969	0.270535927	0.032254116	1	0
44	48.21461646	0.008	0.017	0.001698229	22.68923128	0.450149228	0.05366816	1	0
45								0	0
46	35.7967818	0.000248	0.01843	6.38043E-05	0.481692994	0.022723399	0.002709153	1	0
47	52.62095073	0.008	0.017	0.000350591	24.76280035	0.107109567	0.012769928	1	1
48								0	0
49								0	0
50	57.25493816	0.000248	0.01843	3.37079E-05	0.770440839	0.012714391	0.001515848	1	0
51	132.7380176	0.008	0.017	0.000793	62.46494946	0.225111965	0.026838533	1	0
52								0	0
53								0	0
54	57.34656519	0.008	0.017	0.002408243	26.98661891	0.618596006	0.073750897	1	0
55								0	0
56	39.15168299							1	0
57								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
58								0	0
59								0	0
60								0	0
61								0	0
62								0	0
63								0	0
64								0	0
65	31.00092197	0.05	0.024	0.040256272	64.5852541	8.025245726	0.956794199	1	0
66	1.307113635	0.000248	0.01843	0.000147155	0.017588941	0.048611166	0.005795571	1	0
67								0	0
68								0	0
69	28.29984044	0.00714	0.03	0.001105516	6.735362025	0.304581704	0.036313157	1	1
70	26.84758597	0.000248	0.01843	7.69999E-05	0.361269741	0.02696285	0.003214593	1	0
71								0	0
72								0	0
73								0	0
74								0	0
75								0	0
76								0	0
77								0	0
78								0	0
79	1.215719828	0.008	0.017	0.006167404	0.572103448	1.455636662	0.173545429	1	0
80								0	0
81	28.71421531	0.008	0.017	0.000636602	13.51257191	0.184323172	0.021975569	1	0
82								0	0
83								0	0
84								0	0
85	30.33127682	0.008	0.017	0.000791579	14.27354203	0.22474473	0.02679475	1	0
86	53.71937705	0.0232	0.024	0.003109141	51.92873115	0.780481431	0.09305137	1	0
87								0	0
88								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
89	169.473282	0.008	0.017	0.001059929	79.75213271	0.293131033	0.034947973	1	0
90								0	0
91								0	0
92	23.74489845	0.00714	0.03	0.000568142	5.65128583	0.16619422	0.01981418	1	0
93								0	0
94								0	0
95	295.0712838							1	0
96								0	0
97	149.0088051	0.008	0.017	0.000615721	70.12179062	0.178813107	0.021318642	1	0
98								0	0
99	23.07085915							0	0
100	35.27668415	0.000248	0.01843	2.8568E-05	0.474694393	0.010937326	0.001303981	1	0
101								0	0
102								0	0
103								0	0
104								0	0
105								0	0
106	25.3235572	0.0232	0.024	0.007933059	24.47943862	1.830420346	0.21822828	1	0
107								0	0
108								0	0
109								0	0
110								0	0
111	31.01470354	0.008	0.017	0.001271304	14.59515461	0.345880945	0.041236978	1	0
112								0	0
113								0	0
114								0	0
115	80.29535311	0.008	0.017	0.00199332	37.78604852	0.520804709	0.062091921	1	0
116	48.09628896	0.008	0.017	0.002000103	22.63354775	0.522417247	0.062284173	1	0
117	21.92096215	0.00714	0.03	0.001401761	5.217188991	0.378036068	0.04507061	1	1
118								0	0
119								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
120	32.92825033	0.000248	0.01843	1.11526E-05	0.443093113	0.004646986	0.000554028	1	0
121								0	0
122	20.77997182	0.008	0.017	0.000150253	9.778810269	0.049541504	0.005906489	1	0
123								0	0
124								0	0
125								0	0
126	38.0222189							1	0
127	211.6146545							0	0
128	47.01522599	0.02	0.045	0.008673881	20.89565599	1.985336096	0.236697807	1	0
129	200.5121732							0	1
130	115.9198684	0.000248	0.01843	1.62716E-05	1.559854984	0.006553306	0.000781305	1	0
131	44.87364078	0.000248	0.01843	2.7367E-05	0.603834124	0.010518092	0.001253999	1	0
132								0	0
133								0	0
134								0	0
135	11.61404							0	0
136								0	0
137								0	0
138	1.23811716	0.008	0.017	0.001882968	0.582643369	0.494500784	0.058955887	1	0
139	74.90809238	5.44E-04	0.0226	0.000103342	1.803097445	0.035241399	0.004201587	1	0
140								0	0
141								0	0
142	79.10109506	0.000248	0.01843	2.90743E-05	1.064409744	0.011113551	0.001324991	1	0
143								0	0
144	39.61156595	0.008	0.017	0.001813059	18.64073692	0.477765475	0.056960653	1	0
145								0	0
146	1.790645902	0.008	0.017	0.002111746	0.842656895	0.548887968	0.065440093	1	0
147								0	0
148								0	0
149								0	0
150	39.63019237	0.008	0.017	0.000916126	18.64950229	0.256707891	0.030605495	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
151	25.79400436	0.008	0.017	0.002353424	12.13835499	0.605768966	0.072221618	1	0
152	23.55226963	0.008	0.017	0.002313843	11.083421	0.596490594	0.071115422	1	0
153	13.79026572	0.000248	0.01843	4.87892E-05	0.185566245	0.0178006	0.002122242	1	0
154								0	0
155	48.1928917							1	0
156								0	0
157								0	0
158								0	0
159								0	0
160	40.0400596	0.008	0.017	0.000927821	18.84238099	0.259688194	0.030960816	1	0
161								0	0
162								0	0
163								0	0
164	198.8076249	0.000248	0.01843	1.57108E-05	2.675219261	0.006347461	0.000756764	1	0
165								0	0
166	275.9570668	5.44E-04	0.0226	0.000137744	6.642506386	0.045773568	0.005457264	1	0
167								0	0
168								0	0
169								0	0
170								0	0
171	32.2756362	0.0232	0.024	0.006025392	31.19978166	1.425103643	0.16990519	1	0
172	8.949195322	0.008	0.017	0.000932439	4.211386034	0.26086416	0.031101018	1	0
173	122.1779632	0.008	0.017	0.001857411	57.4955121	0.488389256	0.058227252	1	0
174	12.6617786	0.008	0.017	0.001140031	5.958484046	0.31322322	0.037343425	1	0
175	1.462056272	0.000248	0.01843	4.93977E-05	0.019673899	0.018002519	0.002146315	1	0
176	70.7904911	0.000248	0.01843	1.97938E-05	0.952579587	0.00783252	0.000933817	1	0
177	62.377304							1	0
178								0	0
179								0	0
180								0	0
181								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
182								0	0
183	22.20135402	0.008	0.017	0.000950856	10.44769601	0.265548848	0.031659541	1	0
184	102.8184263							1	0
185								0	0
186	58.10350403	0.008	0.017	0.001463368	27.34282542	0.39312575	0.046869647	1	0
187								0	0
188	8.685396552	0.008	0.017	0.002041301	4.087245436	0.532200494	0.063450561	1	0
189	115.80059	0.000248	0.01843	2.41568E-05	1.558249936	0.009389153	0.001119403	1	1
190								0	0
191	52.67618371	0.0232	0.024	0.003515174	50.92031092	0.872712862	0.104047481	1	0
192	55.19141335	0.008	0.017	0.002800159	25.97242981	0.709571378	0.084597257	1	0
193								0	0
194	45.65269197	0.008	0.017	0.000930846	21.48361975	0.26045848	0.031052652	1	0
195	22.21022919	0.008	0.017	0.00231907	10.45187256	0.59771677	0.071261611	1	0
196	40.0400596	0.008	0.017	0.001347446	18.84238099	0.364682691	0.043478579	1	0
197	8.949195322	0.008	0.017	0.001280942	4.211386034	0.348266397	0.041521379	1	0
198	15.80906805	0.00714	0.03	0.004026939	3.762558196	0.987613729	0.117746312	1	0
199	35.79678129	0.008	0.017	0.000932439	16.84554414	0.26086416	0.031101018	1	0
200								0	0
201	48.46906978	0.000248	0.01843	2.40979E-05	0.652215372	0.009368302	0.001116917	1	0
202	105.1063854	0.0232	0.024	0.001547786	101.6028392	0.413710742	0.049323853	1	0
203	12.6560734	0.0016	0.026	0.000282101	0.778835286	0.087887675	0.010478236	1	0
204								0	0
205	37.50228949	0.008	0.017	0.001564598	17.64813623	0.417797954	0.049811143	1	0
206								0	0
207								0	0
208								0	0
209								0	0
210	113.137085	0.000248	0.01843	1.79105E-05	1.522408957	0.007151344	0.000852605	1	0
211	31.0148968	0.008	0.017	0.000526405	14.59524555	0.155046177	0.018485077	1	0
212								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
213	109.6542192							1	0
214								0	0
215								0	0
216	1.188614111	0.00714	0.03	0.003875784	0.282890158	0.953821386	0.113717486	1	0
217								0	0
218	43.85315386							1	0
219								0	0
220								0	0
221	75.42855567	0.008	0.017	0.002099957	35.49579091	0.546098812	0.065107561	1	0
222								0	0
223								0	1
224								0	0
225	38.0222189							1	0
226	89.49195322	5.44E-04	0.0226	0.000103389	2.154142591	0.035255855	0.00420331	1	0
227								0	0
228	44.64643013	0.008	0.017	0.002219284	21.01008477	0.574266509	0.068465799	1	0
229	33.07391052	0.008	0.017	0.000944024	15.56419319	0.263811821	0.031452448	1	0
230	80.23916346	0.008	0.017	0.001785711	37.75960634	0.471202992	0.056178254	1	0

Table A.7. - Offshore data from 2003-2004

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
1	GAS	DIESEL	MINOR	798.40002	0.198	25	NO					
2	NON-PROCESS		MINOR		0.733	68.979309	NO					
3	GAS		SIGNIFICANT		4.732	19.66	NO					
4	GAS		MINOR		0.952	345	NO					
5	CONDENSATE		SIGNIFICANT		0.311	25	NO					
6	GAS		SIGNIFICANT		1	20.703449	NO					
7	GAS		MINOR		0.53	4.5	NO					
8	GAS		MINOR		1	8	NO					
9	GAS		SIGNIFICANT		1.162	110	NO					
10	OIL	LUB OIL	MINOR	778.44	1	5	NO					
11	NON-PROCESS		MINOR	799.12	0.221	8	NO					
12	GAS		SIGNIFICANT	778.44	1.101	22	NO					
13	OIL		MINOR		0.514	5	NO					
14	OIL	DIESEL	SIGNIFICANT	798.40002	17.259	0.013	NO					
15	CONDENSATE		MINOR	570	0.158	7	NO					
16	NON-PROCESS		MINOR	848.29999	1.323	6.9103451	NO					
17	GAS		MINOR	798.40002	0.766	6.9103451	NO					
18	GAS	DIESEL	SIGNIFICANT		15.684	1.00E-02	NO					
19	NON-PROCESS		MINOR		6.856	2.5	NO					
20	OIL		MINOR		786	22	NO					
21	OIL		MINOR	613	2	0.80000001	NO					
22	OIL		MINOR	798.40002	0.338	23	NO					
23	GAS		MINOR		2.409	1.00E-02	NO					
24	GAS		MINOR		0.1	140	NO					
25	OIL		MINOR	808	0.605	1.5	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL	
26	GAS	LUB OIL	MINOR	948.09998	0.153	169	NO						
27	GAS		SIGNIFICANT		1	140	NO						
28	NON-PROCESS		MINOR		6.793	1.737931	NO						
29	GAS		SIGNIFICANT		4.439	32	NO						
30	GAS		MINOR		2.631	10	NO						
31	GAS		SIGNIFICANT		0.526	170	NO						
32	CONDENSATE		MINOR		598.79999	1	33						NO
33	OIL		SIGNIFICANT		844	25.4	2						NO
34	GAS		MINOR			19.05	0.1						NO
35	OIL		SIGNIFICANT		738.52002	2.721	110						NO
36	NON-PROCESS	HYDRAULIC OIL	SIGNIFICANT	798.40002	7.115	159	NO	IMMEDIATE DELAYED		1			
37	NON-PROCESS	DIESEL	SIGNIFICANT	798.40002	15.27	4	NO						
38	OIL	MINOR	798.40002	0.131	10	NO							
39	GAS	SIGNIFICANT		1	42	NO							
40	OIL	SIGNIFICANT	815	6.667	15.186207	NO							
41	OIL	MINOR	939.1651	9.164	3	NO							
42	OIL	MINOR	858.28003	1	60	NO							
43	2-PHASE	MINOR	834.08002	0.135	10	NO							
44	GAS	MINOR		6.753	1.00E-02	NO							
45	GAS	MINOR		36.672	1.00E-02	YES							
46	NON-PROCESS	LUB OIL	MINOR	798.40002	0.269	2.4000001	YES						
47	OIL		MINOR	839.08002	2	2	NO						
48	GAS		MINOR	1	140	NO							
49	OIL		MINOR	738.52002	0.804	37	NO						
50	CONDENSATE		MINOR	748.5	0.408	12	NO						
51	NON-PROCESS	OIL BASED MUD	MINOR	898.91998	21.81	310.34479	NO	IMMEDIATE		1			
52	GAS	SIGNIFICANT		8.313	0.013	NO							
53	GAS	MINOR		0.312	40	NO							
54	NON-PROCESS	OIL BASED MUD	MINOR	798.40002	1	327.58621	NO						
55	GAS	SIGNIFICANT		5.451	14.3	YES							
56	GAS	MAJOR		21.531	0.2	NO							

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
57	GAS	DIESEL	MINOR	799.12	0.423	143	NO	DELAYED	1	2		
58	GAS		MINOR		4	2.5	NO					
59	NON-PROCESS		MINOR			2	YES					
60	GAS		MINOR		15.772	0.013	YES					
61	GAS		MINOR		2	1.00E-02	NO					
62	OIL	DIESEL HYDRAULIC OIL	MINOR	811.37402	1.967	28.799999	YES	IMMEDIATE	1			
63	GAS		MINOR	798.40002	0.446	40	NO					
64	OIL		SIGNIFICANT		4.763	9.8000002	NO					
65	NON-PROCESS		MINOR	849.065	0.461	6.8965521	NO					
66	NON-PROCESS		MINOR	799.12	0.249	210	YES	IMMEDIATE	1			
67	OIL		MINOR	820	0.125	14	NO					
68	GAS		SIGNIFICANT	600	1	22.772409	NO					
69	GAS		SIGNIFICANT		15.194	32	NO					
70	CONDENSATE		MINOR		1.198	0.80000001	NO					
71	OIL		MINOR		830	0.1	2.8	NO				
72	OIL		MINOR		914.90997	0.411	0.5	NO				
73	OIL		MINOR		799.12	6.604	4.1999998	NO				
74	GAS		MAJOR		63.411	2.4000001	NO					
75	OIL		MINOR		825	4.775	1.00E-02	NO				
76	CONDENSATE		MINOR		779.14203	0.573	70	NO				
77	CONDENSATE		MINOR		839.07599	1.8	68.300003	NO				
78	GAS		SIGNIFICANT		25.36	16	NO					
79	2-PHASE		MINOR	830	0.774	14.5	NO					
80	OIL		MINOR	800	1	26	NO					
81	GAS		SIGNIFICANT	798.40002	2.064	178	NO					
82	GAS		SIGNIFICANT		5.039	71	NO					
83	GAS		SIGNIFICANT		1.209	18.987	NO					
84	OIL		MINOR	785.42603	4.936	0.213	NO					
85	GAS		MINOR		1.413	82.769997	NO					
86	OIL		MINOR		0.6	12	NO					
87	GAS		MINOR		0.224	60	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN. TYPE	FLASH	EXPLOSION	JET	POOL
88	OIL	LUB OIL	MINOR	798.40002	1	0.5	NO	IMMEDIATE	1			
89	GAS		SIGNIFICANT		3.382	27.6	NO					
90	CONDENSATE		MINOR	598.79999	6.201	0.013	NO					
91	GAS		SIGNIFICANT		1.011	100	NO					
92	GAS		SIGNIFICANT		3.5	0.48699999	NO					
93	GAS		MINOR		0.25	173	NO					
94	NON-PROCESS		MINOR	799.12	0.669	1	YES					
95	OIL		SIGNIFICANT	799.12	0.1	1	NO					
96	GAS		SIGNIFICANT		4.774	5.00E-02	NO					
97	GAS		MINOR		52.176	5.00E-02	NO					
98	OIL	DIESEL	MINOR	798.40002	0.927	27	NO					
99	NON-PROCESS		MINOR	848.29999	1.643	2	NO					
100	GAS		MINOR		15.738	6.90E-02	NO					
101	GAS		MINOR		0.352	75	NO					
102	GAS		SIGNIFICANT		0.581	164	NO					
103	OIL		MINOR	844.79999	9	36	NO					
104	GAS		SIGNIFICANT		20.574	13	NO					
105	OIL		MINOR	798.40002	28.973	0.013	NO					
106	GAS		SIGNIFICANT		5.345	100	NO					
107	GAS		MINOR		1.233	10.01379	NO					
108	GAS		MINOR		2.144	15.18621	NO					
109	GAS		MAJOR		2.14	67.5	NO					
110	GAS		SIGNIFICANT		1.549	143.5	NO					
111	GAS		SIGNIFICANT		5.071	30	NO					
112	GAS		MINOR		3	0.5	NO					
113	2-PHASE		MAJOR	742.8114	7.574	26.700001	NO					
114	GAS		MINOR		0.564	116	NO					
115	GAS		SIGNIFICANT		12.157	13	NO					
116	GAS		MINOR		0.068	130	NO					
117	2-PHASE		SIGNIFICANT	798.40002	7.349	60	NO					
118	OIL		MINOR	1025	0.615	9	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
119	OIL		MINOR	858.28003	0.379	65	NO					
120	GAS		SIGNIFICANT		3.659	1	NO					
121	CONDENSATE		MINOR	598.79999	15.248	2	NO					
122	GAS		MINOR		2.108	2.49E-02	NO					
123	OIL		MINOR	838.32001	0.991	10	NO					
124	GAS		SIGNIFICANT		6	79.324127	NO					
125	OIL		MINOR	739.18597	6.562	0.013	NO					
126	GAS		SIGNIFICANT		0.657	68	NO					
127	OIL		MINOR	790	0.717	30	NO					
128	2-PHASE		SIGNIFICANT	799.12	1.059	14	NO					
129	OIL		SIGNIFICANT	821	4	13	NO					
130	GAS		SIGNIFICANT		0.149	167	NO					
131	GAS		MINOR		8.552	6.00E-02	NO					
132	OIL		MINOR	821.354	2.856	25	NO					
133	GAS		MINOR		0.096	120	NO					
134	OIL		MINOR	821	1	30	NO					
135	OIL		MINOR	820	0.1	14	NO					
136	OIL		SIGNIFICANT	830.16998	2.608	20	NO					
137	GAS		SIGNIFICANT		1.681	70	NO					
138	GAS		SIGNIFICANT		2	0.1	NO					
139	OIL		MINOR	825	1	17.5	NO					
140	NON-PROCESS	DIESEL	MINOR	798.40002	1.2	60	NO					
141	GAS		SIGNIFICANT		4	25	NO					
142	GAS		SIGNIFICANT		37.089	0.442	NO					
143	GAS		MAJOR		7.657	70	NO					
144	NON-PROCESS	HYDRAULIC OIL	MINOR	798.40002	2	250	NO					
145	GAS		MINOR		1.067	16	NO					
146	GAS		SIGNIFICANT		4.822	24	NO					
147	GAS		MINOR		0.215	140	NO					
148	GAS		SIGNIFICANT		2.125	151.72411	NO					
149	OIL		SIGNIFICANT	841	1.882	25	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
150	GAS		MINOR		0.71	5	NO					
151	OIL		MINOR	848.29999	0.441	5	NO					
152	OIL		MINOR	812	0.1	50	NO					
153	OIL		MINOR	848.91498	2.691	10	NO					
154	OIL		MINOR	798.40002	0.051	13.7	NO					
155	GAS		MINOR		1	2	NO					
156	OIL		MINOR	756.48401	0.5	2.5	NO					
157	GAS		SIGNIFICANT		1	158.6207	NO					
158	GAS		MINOR		0.1	70	NO					
159	GAS		SIGNIFICANT		1.122	1.5	NO					
160	GAS		SIGNIFICANT		4	15	NO					
161	OIL		MINOR	860	1.517	9	NO					
162	GAS		SIGNIFICANT		7.761	16	NO					
163	GAS		MINOR		0.75	1	NO					
164	CONDENSATE		MINOR	700	1.661	0.1	NO					
165	OIL		MINOR	798.40002	29.212	103.45	NO					
166	CONDENSATE		SIGNIFICANT	821	2.693	30	NO					
167	OIL		MINOR	835	0.307	101.3793	NO					
168	OIL		MINOR	798.40002	10.571	0.013	NO					
169	OIL		MINOR	756.48401	1	24	NO					
170	GAS		MINOR		0.263	140	NO					
171	NON-PROCESS	DIESEL	MINOR	798.40002	6.591	8	NO					
172	CONDENSATE		SIGNIFICANT	611.77399	6.729	30	NO					
173	CONDENSATE		MINOR	598.79999	1.392	0.013	NO					
174	NON-PROCESS	LUB OIL	MINOR	893.20001	0.2	363	YES	DELAYED	1			
175	NON-PROCESS	DIESEL	MINOR	799.12	2.812	8	NO					
176	NON-PROCESS	OIL BASED MUD	MINOR	850	1.632	3	NO					
177	GAS		SIGNIFICANT		0.551	200	NO					
178	OIL		MINOR	890	0.173	4.5	NO					
179	GAS		MINOR		0.5	6.551724	NO					
180	OIL		SIGNIFICANT	798.40002	13.224	1	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
181	GAS		MINOR		0.5	38	NO					
182	OIL		MINOR	860	0.181	50	NO					
183	GAS		MINOR		0.3	179	NO					
184	GAS		SIGNIFICANT		6	0.1	NO					
185	GAS		MINOR		1.632	18	NO					
186	CONDENSATE		SIGNIFICANT	650	10	79	NO					
187	GAS		MINOR		0.154	6.0100002	NO					
188	OIL		SIGNIFICANT	799.12	4.573	6.5	NO					
189	GAS		SIGNIFICANT		21.333	1	NO					
190	2-PHASE		SIGNIFICANT	798.40002	4	49.65517	NO					
191	GAS		SIGNIFICANT		8	72	NO					
192	GAS		MINOR		0.238	212.6207	NO					
193	GAS		SIGNIFICANT		3.381	0.013	NO					
194	OIL		MINOR	821	0.533	12	NO					
195	GAS		SIGNIFICANT		1.764	200	NO					
196	NON-PROCESS	DIESEL	SIGNIFICANT	799.12	5.845	45	NO					
197	OIL		MINOR	779.14203	0.1	7	NO					
198	NON-PROCESS	DIESEL	SIGNIFICANT	899.00989	10.16	5	NO					
199	NON-PROCESS	HEAT TRANSFER OIL	MINOR	798.40002	0.136	11	YES	DELAYED				1
200	OIL		MINOR	820	0.107	2	NO					
201	GAS		SIGNIFICANT		6.847	3.448276	NO					
202	GAS		MINOR		0.103	170	NO					
203	NON-PROCESS	DIESEL	MINOR	900	1.671	2	NO					
204	CONDENSATE		MINOR	845	1.211	6	NO					
205	GAS		MINOR		0.85	13.5	NO					
206	NON-PROCESS	LUB OIL	MINOR	848.29999	1.21	3.1034479	YES	DELAYED				1
207	CONDENSATE		MINOR	598.79999	0.208	0.013	YES	DELAYED				1
208	GAS		SIGNIFICANT		0.6	101	NO					
209	GAS		SIGNIFICANT		0.661	83	NO					
210	NON-PROCESS	DIESEL	MINOR	899.00989	10.574	2	NO					
211	NON-PROCESS	DIESEL	MINOR	799.12	1.291	45	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
212	NON-PROCESS	HYDRAULIC OIL	MINOR	798.40002	1.459	27.58621	NO					
213	GAS		SIGNIFICANT		4.923	166.10001	NO					
214	GAS		MINOR		0.25	113.7931	NO					
215	GAS		MINOR		0.1	180	NO					
216	OIL		MINOR	821	6	13	NO					
217	CONDENSATE		MINOR	798.40002	0.51	20.689659	NO					
218	OIL		MINOR	798.40002	1	50	NO					
219	GAS		MINOR		3.408	0.02	NO					
220	GAS		SIGNIFICANT		12.585	4	NO					
221	GAS		SIGNIFICANT		0.744	59	NO					
222	GAS		SIGNIFICANT		0.8	20	NO					
223	GAS		SIGNIFICANT		9.031	23	NO					
224	GAS		SIGNIFICANT		4	167	NO					
225	GAS		MINOR		0.046	130	NO					
226	2-PHASE		MINOR	987.02002	0.561	28	NO					
227	OIL		SIGNIFICANT	835	10	25	NO					
228	GAS		SIGNIFICANT		1.597	155.17239	NO					
229	GAS		MINOR		16.013	0.40000001	NO					
230	GAS		SIGNIFICANT		2	3	NO					
231	NON-PROCESS		LUB OIL	MINOR	848.29999	0.5	2.758621					
232	OIL	MINOR		815	1.04	0.48275861	NO					
233	GAS	MINOR			0.312	129	NO					
234	OIL	MINOR		799.12	0.02	14	NO					
235	OIL	MINOR		821.34998	0.5	75	NO					
236	OIL	MINOR		798.40002	1.135	12	NO					
237	CONDENSATE	MINOR		532.93201	0.286	31.034479	NO					
238	GAS	SIGNIFICANT			2	38.700001	NO					
239	GAS	SIGNIFICANT			1.1	140	NO					
240	NON-PROCESS	DIESEL	MINOR	849.065	1.359	6.2068968	NO					
241	CONDENSATE		MINOR	648.70001	0.295	134	NO					
242	GAS		MINOR		0.098	3	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
243	NON-PROCESS	DIESEL	MINOR	849.065	4.348	41	YES	DELAYED	1		2	
244	OIL		SIGNIFICANT	798.40002	10.262	2	NO					
245	GAS		MINOR		1.561	0.013	NO					
246	GAS		MINOR		0.1	181	NO					
247	NON-PROCESS	DIESEL	SIGNIFICANT	849.065	10.225	7	NO					
248	OIL		MINOR	821.34998	0.161	75	NO					
249	CONDENSATE		MINOR	716	0.5	32	NO					
250	GAS		MINOR		1	14	NO					
251	OIL		MINOR	828.34003	1	27	NO					
252	OIL		MINOR	821.34998	0.317	75	NO					
253	GAS		MINOR		1	1.16	NO					
254	GAS		SIGNIFICANT		10.154	0	NO					
255	GAS		SIGNIFICANT		8.228	10	NO					
256	CONDENSATE		MINOR	799.12	0.669	1	NO					
257	GAS		SIGNIFICANT		4.743	6.5	NO					
258	OIL		MINOR	828.34003	11.685	1	NO					
259	GAS		SIGNIFICANT		1	65	NO					
260	OIL		MINOR	941	1.184	3	NO					
261	GAS		MINOR		0.103	130	NO					
262	OIL		MINOR	813.37	1.2	15.18	NO					
263	GAS		SIGNIFICANT		6.682	6.8965521	NO					
264	OIL		MINOR	788	0.223	80	NO					
265	GAS		SIGNIFICANT		2	181	NO					
266	2-PHASE		SIGNIFICANT	1025	3.67	23	NO					
267	OIL		MINOR	838	0.1	30	NO					
268	GAS		MINOR		4	0.30000001	NO					
269	OIL		MINOR	768.46002	0.1	17	NO					

Table A.8. - Analysis of offshore data from 2003-2004

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1								0	0
2	105.1608614	0.0232	0.024	0.002749514	101.6554994	0.697883038	0.083203738	1	0
3								0	0
4								0	0
5	73.10281435	0.000248	0.01843	1.4529E-05	0.983694952	0.00591145	0.000704781	1	0
6								0	0
7								0	0
8								0	0
9								0	0
10	28.6732826	0.008	0.017	0.000920295	13.49330946	0.257770608	0.030732196	1	0
11	35.79678129	0.00714	0.03	0.00051971	8.519633946	0.15325064	0.018271007	1	0
12								0	0
13	28.6732826	0.008	0.017	0.000659794	13.49330946	0.19042397	0.022702925	1	0
14	1.44366488	0.008	0.017	0.003871975	0.679371708	0.952968206	0.113615767	1	0
15	39.64757022	0.000248	0.01843	1.01037E-05	0.53351044	0.004247534	0.000506404	1	0
16	32.29089795	0.0232	0.024	0.003807573	31.21453468	0.93853338	0.111894803	1	0
17								0	0
18								0	0
19	20.0200298	0.0232	0.024	0.008408902	19.35269547	1.930067742	0.230108545	1	0
20	59.85563633	0.008	0.017	0.000767601	28.16735828	0.218541017	0.026055125	1	0
21	12.92467835	0.008	0.017	0.001154941	6.082201576	0.316948805	0.0377876	1	0
22	60.72375694	0.008	0.017	0.000541855	28.57588562	0.159181796	0.018978138	1	0
23								0	0
24								0	0
25	15.41504987	0.008	0.017	0.000729286	7.254141113	0.208591602	0.024868925	1	0
26								0	0
27								0	0
28	15.31772192	0.00714	0.03	0.003138461	3.645617817	0.787176315	0.093849554	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
29								0	0
30								0	0
31								0	0
32	83.98873933	0.000248	0.01843	2.60529E-05	1.130179455	0.010057455	0.00119908	1	0
33	17.41601377	0.008	0.017	0.004829504	8.195771185	1.16522853	0.138922089	1	0
34								0	0
35	138.0766339	0.008	0.017	0.001478631	64.97723948	0.396855383	0.047314306	1	0
36	159.6589532	0.00714	0.03	0.002947519	37.99883085	0.743473132	0.088639128	1	0
37	25.3235572	0.0232	0.024	0.012549412	24.47943862	2.778478856	0.331258698	1	0
38	40.0400596	0.008	0.017	0.000337334	18.84238099	0.103417668	0.012329769	1	0
39								0	0
40	48.83720919	0.008	0.017	0.002431412	22.98221609	0.624009245	0.07439628	1	0
41	20.220628	0.008	0.017	0.003060046	9.515589645	0.769258408	0.091713327	1	0
42	94.59454796	0.008	0.017	0.000966338	44.51508139	0.269480382	0.032128271	1	0
43	39.17428926							1	0
44								0	0
45								0	1
46	19.61554347	0.00714	0.03	0.00057312	4.668499345	0.16751858	0.019972075	1	1
47	17.46699889	0.008	0.017	0.001351236	8.219764185	0.365615956	0.043589846	1	0
48								0	0
49	80.08011912	0.008	0.017	0.000803755	37.68476194	0.227888438	0.027169553	1	0
50	45.30015683	0.000248	0.01843	1.86055E-05	0.609573461	0.007403422	0.000882658	1	0
51	210.2164499							0	0
52								0	0
53								0	0
54	229.1698714							0	0
55								0	1
56								0	0
57								0	0
58								0	0
59	17.89839064	0.0232	0.024	0	17.30177762	0	0	1	1
60								0	1
61								0	0
62	67.4047764	0.008	0.017	0.001317732	31.71989478	0.357357201	0.042605212	1	1

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
63								0	0
64	39.63763713	0.008	0.017	0.002034066	18.65300571	0.530483604	0.063245868	1	0
65	32.2441198	0.0232	0.024	0.002248612	31.16931581	0.58116846	0.069288671	1	0
66	183.4039277	0.00714	0.03	0.000551651	43.6501348	0.161798509	0.01929011	1	1
67	46.74789678	0.008	0.017	0.000333946	21.99901025	0.102472024	0.012217026	1	0
68								0	0
69								0	0
70	13.06394538	0.000248	0.01843	2.85442E-05	0.175792645	0.010929028	0.001302992	1	0
71	20.77997182	0.008	0.017	0.000300506	9.778810269	0.093090741	0.011098561	1	0
72	8.363745455	0.008	0.017	0.000639624	3.935880214	0.185119061	0.022070457	1	0
73	25.93723158	0.008	0.017	0.002396205	12.20575604	0.615781489	0.073415342	1	0
74								0	0
75	1.245598298	0.008	0.017	0.002070275	0.586163905	0.539070278	0.064269598	1	0
76	107.237255	0.000248	0.01843	2.24957E-05	1.443018949	0.008799759	0.001049134	1	0
77	102.0738978	0.000248	0.01843	4.13763E-05	1.373539157	0.015321576	0.001826685	1	0
78								0	0
79	47.2878904							1	0
80	64.49806199	0.008	0.017	0.000932952	30.35202917	0.260994827	0.031116597	1	0
81								0	0
82								0	0
83								0	0
84	5.843654314	0.008	0.017	0.002070677	2.749954971	0.539165375	0.064280936	1	0
85								0	0
86	44.22246661	0.008	0.017	0.000716049	20.81057252	0.205143462	0.024457827	1	0
87								0	0
88	8.953229509	0.008	0.017	0.000932019	4.213284475	0.260757195	0.031088266	1	0
89								0	0
90	1.667000648	0.000248	0.01843	6.48763E-05	0.022431696	0.023070561	0.002750542	1	0
91								0	0
92								0	0
93								0	0
94	12.6560734	0.00714	0.03	0.000904228	3.012145468	0.253672095	0.030243559	1	1
95	12.6560734	0.008	0.017	0.000294863	5.955799245	0.091498593	0.01090874	1	0
96								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
97								0	0
98	65.79253154	0.008	0.017	0.000897356	30.96119131	0.25191706	0.030034318	1	0
99	17.37181724	0.0232	0.024	0.004243138	16.79275666	1.035750342	0.123485305	1	0
100								0	0
101								0	0
102								0	0
103	73.85489502	0.008	0.017	0.002876157	34.75524472	0.727075183	0.086684114	1	0
104								0	0
105	1.44366488	0.008	0.017	0.005016738	0.679371708	1.206266669	0.14381478	1	0
106								0	0
107								0	0
108								0	0
109								0	0
110								0	0
111								0	0
112								0	0
113	67.82992604							1	0
114								0	0
115								0	0
116								0	0
117	98.07771529							1	0
118	33.5246542	0.008	0.017	0.000828159	15.77630786	0.234176597	0.027919246	1	0
119	98.45712711	0.008	0.017	0.000594906	46.3327657	0.173303764	0.020661802	1	0
120								0	0
121	20.6765983	0.000248	0.01843	0.000101733	0.278230948	0.03474161	0.004142	1	0
122								0	0
123	39.07509734	0.008	0.017	0.000950728	18.3882811	0.26551615	0.031655643	1	0
124								0	0
125	1.500374946	0.008	0.017	0.002297256	0.706058798	0.592598269	0.070651368	1	0
126								0	0
127	69.71914725	0.008	0.017	0.000785032	32.80901047	0.223052707	0.026593022	1	0
128	47.35469051							1	0
129	45.01995768	0.008	0.017	0.001890236	21.18586244	0.49623728	0.059162918	1	0
130								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
131								0	0
132	62.41799311	0.008	0.017	0.001597566	29.37317323	0.42580157	0.050765358	1	0
133								0	0
134	68.39022517	0.008	0.017	0.000945118	32.18363537	0.264090082	0.031485623	1	0
135	46.74789678	0.008	0.017	0.00029869	21.99901025	0.092578738	0.011037519	1	0
136	55.5311248	0.008	0.017	0.0015348	26.13229402	0.410550801	0.048947115	1	0
137								0	0
138								0	0
139	52.10711578	0.008	0.017	0.000947418	24.52099566	0.264674744	0.031555328	1	0
140	98.07771529	0.0232	0.024	0.003517989	94.80845811	0.873348948	0.104123317	1	0
141								0	0
142								0	0
143								0	0
144	200.200298	0.00714	0.03	0.001562731	47.64767092	0.417344164	0.04975704	1	0
145								0	0
146								0	0
147								0	0
148								0	0
149	61.68463386	0.008	0.017	0.001312267	29.02806299	0.356008248	0.042444386	1	0
150								0	0
151	27.46725479	0.008	0.017	0.000637982	12.92576696	0.184686656	0.022018905	1	0
152	88.77935232	0.008	0.017	0.00029723	41.77851874	0.092166681	0.010988392	1	0
153	38.83049137	0.008	0.017	0.001576534	18.27317241	0.420697467	0.050156831	1	0
154	46.8656882	0.008	0.017	0.00021048	22.05444151	0.067325677	0.008026772	1	0
155								0	0
156	20.56719723	0.008	0.017	0.000641504	9.678681051	0.185614199	0.022129489	1	0
157								0	0
158								0	0
159								0	0
160								0	0
161	36.59965688	0.008	0.017	0.001191397	17.22336794	0.326040229	0.038871508	1	0
162								0	0
163								0	0
164	4.276179871	0.000248	0.01843	3.63035E-05	0.05754165	0.01360231	0.001621709	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
165	128.7834226	0.008	0.017	0.005037388	60.60396356	1.210784042	0.144353355	1	0
166	68.39022517	0.000248	0.01843	5.00615E-05	0.920280838	0.018222524	0.002172545	1	0
167	124.6626605	0.008	0.017	0.000528113	58.66478141	0.155503892	0.018539647	1	0
168	1.44366488	0.008	0.017	0.00303028	0.679371708	0.762446041	0.090901135	1	0
169	63.72512989	0.008	0.017	0.000907224	29.98829642	0.254436752	0.030334723	1	0
170								0	0
171	35.81291803	0.0232	0.024	0.008244789	34.6191541	1.895759238	0.226018181	1	0
172	79.22643385	0.000248	0.01843	6.83101E-05	1.066096343	0.024179163	0.002882713	1	0
173	1.667000648	0.000248	0.01843	3.07379E-05	0.022431696	0.011690792	0.001393812	1	0
174	228.0782845	0.00714	0.03	0.000522695	54.28263171	0.154051406	0.018366477	1	1
175	35.79678129	0.0232	0.024	0.005387748	34.60355524	1.287183363	0.153461915	1	0
176	21.25475725							0	0
177								0	0
178	25.43994912	0.008	0.017	0.000409291	11.97174076	0.123313148	0.014701768	1	0
179								0	0
180	12.6617786	0.008	0.017	0.00338927	5.958484046	0.84422147	0.100650651	1	0
181								0	0
182	86.26621856	0.008	0.017	0.000411531	40.59586756	0.123927161	0.014774973	1	0
183								0	0
184								0	0
185								0	0
186	124.7273951	0.000248	0.01843	8.58363E-05	1.678371892	0.029764627	0.003548629	1	0
187								0	0
188	32.26678261	0.008	0.017	0.001993981	15.18436829	0.520961899	0.062110662	1	0
189								0	0
190	89.22302673							1	0
191								0	0
192								0	0
193								0	0
194	43.25377625	0.008	0.017	0.000690001	20.35471823	0.198341216	0.023646843	1	0
195								0	0
196	84.89952133	0.0232	0.024	0.00776769	82.06953728	1.795665355	0.214084684	1	0
197	33.91139758	0.008	0.017	0.000291154	15.95830474	0.090450615	0.010783797	1	0
198	26.68134708	0.0232	0.024	0.010862323	25.79196884	2.436404874	0.290475598	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
199	41.99436879	0.00714	0.03	0.00040751	9.994659772	0.122824753	0.014643541	1	1
200	17.66904417	0.008	0.017	0.000308968	8.314844316	0.095473068	0.011382589	1	0
201								0	0
202								0	0
203	16.86548085	0.0232	0.024	0.004407609	16.30329816	1.072221757	0.127833538	1	0
204	30.14756607	0.000248	0.01843	3.40577E-05	0.405675333	0.012834391	0.001530155	1	0
205								0	0
206	21.63976217	0.00714	0.03	0.001252928	5.150263396	0.341328616	0.040694236	1	1
207	1.667000648	0.000248	0.01843	1.18819E-05	0.022431696	0.00492274	0.000586904	1	1
208								0	0
209								0	0
210	16.87476556	0.0232	0.024	0.011081422	16.31227338	2.481085364	0.295802542	1	0
211	84.89952133	0.0232	0.024	0.003650587	82.06953728	0.903253991	0.107688687	1	0
212	66.502923	0.00714	0.03	0.00133474	15.82769567	0.361552072	0.043105337	1	0
213								0	0
214								0	0
215								0	0
216	45.01995768	0.008	0.017	0.002315057	21.18586244	0.596775397	0.071149378	1	0
217	57.59322283	0.000248	0.01843	2.14837E-05	0.774992906	0.00843878	0.001006097	1	0
218	89.53229509	0.008	0.017	0.000932019	42.13284475	0.260757195	0.031088266	1	0
219								0	0
220								0	0
221								0	0
222								0	0
223								0	0
224								0	0
225								0	0
226	60.25887504							1	0
227	61.9058586	0.008	0.017	0.0030141	29.13216875	0.758740561	0.090459357	1	0
228								0	0
229								0	0
230								0	0
231	20.40216581	0.00714	0.03	0.000805413	4.855715464	0.22831619	0.02722055	1	1
232	8.707454114	0.008	0.017	0.000960307	4.097625466	0.267949429	0.031945746	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
233								0	0
234	47.35469051	0.008	0.017	0.000131867	22.28456024	0.043992948	0.005244973	1	0
235	108.1113999	0.008	0.017	0.000668442	50.87595291	0.192693764	0.022973537	1	0
236	43.86168769	0.008	0.017	0.000992939	20.64079421	0.276222733	0.032932114	1	0
237	86.33587822	0.000248	0.01843	1.31442E-05	1.16176331	0.005396437	0.00064338	1	0
238								0	0
239								0	0
240	30.5894577	0.0232	0.024	0.003860769	29.56980911	0.950458084	0.113316503	1	0
241	162.6055751	0.000248	0.01843	1.47281E-05	2.18807285	0.005985134	0.000713566	1	0
242								0	0
243	78.61880599	0.0232	0.024	0.006905718	75.99817912	1.613391835	0.192353481	1	1
244	17.90645902	0.008	0.017	0.002985663	8.426568949	0.752223445	0.089682366	1	0
245								0	0
246								0	0
247	32.48504969	0.0232	0.024	0.010589994	31.4022147	2.380756207	0.283840994	1	0
248	108.1113999	0.008	0.017	0.000379308	50.87595291	0.115064693	0.013718363	1	0
249	75.63511348	0.000248	0.01843	2.01445E-05	1.017770382	0.007958691	0.000948859	1	0
250								0	0
251	64.59256668	0.008	0.017	0.000949333	30.39650197	0.265161759	0.031613391	1	0
252	108.1113999	0.008	0.017	0.000532241	50.87595291	0.156609562	0.018671468	1	0
253								0	0
254								0	0
255								0	0
256	12.6560734	0.000248	0.01843	2.46169E-05	0.170304189	0.009551734	0.001138787	1	0
257								0	0
258	12.43084525	0.008	0.017	0.003245138	5.849809531	0.811487728	0.096748035	1	0
259								0	0
260	20.2009038	0.008	0.017	0.001100994	9.506307671	0.303447985	0.036177992	1	0
261								0	0
262	48.87612824	0.008	0.017	0.001030503	23.00053093	0.28571598	0.034063928	1	0
263								0	0
264	113.99528	0.008	0.017	0.00043725	53.64483764	0.130955607	0.015612926	1	0
265								0	0
266	53.59286447							1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
267	67.69297528	0.008	0.017	0.000301951	31.85551778	0.093497927	0.011147107	1	0
268								0	0
269	53.21313021	0.008	0.017	0.000289151	25.04147304	0.089884258	0.010716275	1	0

Table A.9. - Offshore data from 2004-2005

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN. TYPE	FLASH	EXPLOSION	JET	POOL
1	GAS		MINOR		0.634	20	NO					
2	NON-PROCESS	OIL BASED MUD	MINOR	899	>100	0.013	NO					
3	CONDENSATE		MINOR	799.12	1.7	40	NO					
4	OIL		MINOR	799.12	0.689	8	NO					
5	2-PHASE		MINOR	913	0.172	28	NO					
6	OIL		MINOR	830	2	3	NO					
7	NON-PROCESS	DIESEL	MINOR	849.065	2.289	4.8275862	NO					
8	NON-PROCESS	HYDRAULIC OIL	MINOR	799.12	3.62	186	NO					
9	OIL		MINOR	799.12	0.079	13	NO					
10	NON-PROCESS	LUB OIL	MINOR	895	0.264	364	YES	DELAYED	1			
11	NON-PROCESS	DIESEL	MINOR	799.12	0.2	0.013	YES	DELAYED	1			
12	OIL		MINOR	815	4.545	0.28	NO					
13	NON-PROCESS	FUEL OIL	MINOR	899.01001	6.651	22.758619	NO					
14	OIL		MINOR	923.98248	0.247	7	NO					
15	NON-PROCESS	METHANOL	MINOR	811.87	2.42	180	NO					
16	NON-PROCESS	LUB OIL	MINOR	849.065	0.072	6.987	YES	DELAYED				1
17	GAS		MINOR		1.816	33	NO					
18	2-PHASE		MINOR	832	0.531	15.4	NO					
19	NON-PROCESS	DIESEL	MINOR	799.12	0.504	10	NO					
20	GAS		MINOR		0.02	26	NO					
21	GAS		MINOR		1.55	28	NO					
22	OIL		MINOR	820	6.638	1	NO					
23	NON-PROCESS	HEAT TRANSFER OIL	MINOR	829.08698	2	10	NO					
24	OIL		MINOR	799.12	0.579	4	NO					
25	NON-PROCESS	DIESEL	MINOR	849.065	1.063	6	NO					
26	GAS		MINOR		0.169	115.487	NO					
27	CONDENSATE		MINOR	699.22998	1	1.5	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
28	NON-PROCESS	HYDRAULIC OIL	MINOR	799.12	1	300	NO					
29	CONDENSATE		MINOR	699.22998	N/A	0.013	YES	DELAYED	1			
30	NON-PROCESS	DIESEL	MINOR	849.065	3	6	NO					
31	GAS		MINOR		1	5.00E-02	YES	IMMEDIATE	1	2		
32	OIL		MINOR	828	0.452	5	NO					
33	OIL		MINOR	799.12	0.307	10	NO					
34	GAS		MINOR		0.5	41.379311	NO					
35	GAS		MINOR		0.1	106	NO					
36	NON-PROCESS	BOTTLED GAS	MINOR	1	2	0.30000001	YES	IMMEDIATE		1	2	
37	OIL		MINOR	859	1.284	48.987	NO					
38	GAS		MINOR		0.1	7.517241	NO					
39	OIL		MINOR	820	14.282	0.013	NO					
40	GAS		MINOR		2.639	1	NO					
41	GAS		SIGNIFICANT		3	93	NO					
42	GAS		MINOR		2	20	NO					
43	NON-PROCESS	DIESEL	MINOR	799.12	3.141	2	NO					
44	NON-PROCESS	LUB OIL	MINOR	1066.75	1	0.2068966	YES	IMMEDIATE	1			
45	2-PHASE		MINOR	799.12	0.523	85	NO					
46	2-PHASE		SIGNIFICANT	749.16998	0.751	22.5	NO					
47	GAS		MINOR		0.1	75.862068	NO					
48	GAS		SIGNIFICANT		1	25	NO					
49	OIL		SIGNIFICANT	830.16998	5	0.2	NO					
50	OIL		SIGNIFICANT	864.04999	6	58.987	NO					
51	NON-PROCESS	DIESEL	MINOR	799.12	9.407	10	NO					
52	GAS		SIGNIFICANT		2	130	NO					
53	GAS		MINOR		1.5	2.49	NO					
54	GAS		SIGNIFICANT		2	145	NO					
55	NON-PROCESS	METHANOL	MINOR	799.12	3.6	1	NO					
56	GAS		SIGNIFICANT		3.242	220	NO					
57	GAS		SIGNIFICANT		3.326	179.2	NO					
58	GAS		MINOR		2.858	2.49	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
59	GAS		MINOR		0.6	180	NO					
60	GAS		MINOR		5	25	NO					
61	GAS		MINOR		6.521	1.35	NO					
62	OIL		MINOR	821	2.51	13	NO					
63	OIL		MAJOR	819.09802	9.8	2.5	NO					
64	GAS		MINOR		0.1	108.987	NO					
65	OIL		MINOR	799.12	5.281	1	NO					
66	GAS		MINOR		0.1	200	NO					
67	GAS		SIGNIFICANT		1.8	15.5	NO					
68	NON-PROCESS	DIESEL	SIGNIFICANT	849.065	4.5	0.34999999	NO					
69	CONDENSATE		SIGNIFICANT	600	2.5	27	NO					
70	NON-PROCESS	LUB OIL	MINOR	869.04303	1	2	YES	IMMEDIATE	1			
71	OIL		MINOR	790	1	25	NO					
72	CONDENSATE		MINOR	810	0.13	19.65517	NO					
73	GAS		MINOR		1	20	NO					
74	OIL		MINOR	999.82001	15	2.5	NO					
75	GAS		SIGNIFICANT		3.049	8	NO					
76	OIL		MINOR	839	1.588	11.987	NO					
77	GAS		MINOR		0.5	34	NO					
78	GAS		SIGNIFICANT		1.5	22	NO					
79	GAS		SIGNIFICANT		6	40	NO					
80	GAS		SIGNIFICANT		8.5	2	NO					
81	GAS		MINOR		0.268	33	NO					
82	OIL		MINOR	1018.878	2.903	8.00E-03	NO					
83	GAS		SIGNIFICANT		15	1	NO					
84	GAS		MINOR		2.5	1	NO					
85	GAS		MINOR		1.582	0.013	NO					
86	GAS		MINOR		0.1	184	NO					
87	GAS		MINOR		2.066	17	NO					
88	OIL		MINOR	899.70923	10	9	NO					
89	GAS		SIGNIFICANT		23.534	1	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
90	GAS		SIGNIFICANT		0.584	128	NO					
91	CONDENSATE		MINOR	781	25	1.00E-02	NO					
92	OIL		MINOR	810	1	6.8000002	NO					
93	GAS		MINOR		0.5	68.987	NO					
94	OIL		MINOR	799.12	1	8.3999996	NO					
95	GAS		MINOR		0.25	120	NO					
96	GAS		MINOR		0.25	199.5	NO					
97	OIL		MINOR	840	1	25	NO					
98	GAS		SIGNIFICANT		2	26	NO					
99	OIL		MAJOR	839.07599	5	4	NO					
100	GAS		MINOR		0.1	219	NO					
101	GAS		MINOR		1	24.13793	NO					
102	GAS		MINOR		0.1	87	NO					
103	OIL		MINOR	799.12	2.677	0.60000002	NO					
104	OIL		MINOR	799.12	2	60	NO					
105	GAS		MAJOR		1	96	NO					
106	GAS		MINOR		0.332	75	NO					
107	GAS		MINOR		0.01	10	NO					
108	OIL		MINOR	899.01001	0.21	21.4	NO					
109	NON-PROCESS	LUB OIL	MINOR	850	1.574	30	NO					
110	GAS		SIGNIFICANT		4.98	127.987	NO					
111	GAS		MINOR		6.35	0.013	NO					
112	GAS		MINOR		0.1	130	NO					
113	GAS		MINOR		1	35	NO					
114	NON-PROCESS	HYDRAULIC OIL	MINOR	820	1	344.82761	NO					
115	GAS		MINOR		0.1	64	NO					
116	GAS		MINOR		0.196	13	NO					
117	NON-PROCESS	DIESEL	SIGNIFICANT	850	2	4.8275862	YES	DELAYED	1			
118	GAS		SIGNIFICANT		2	145	NO					
119	GAS		SIGNIFICANT		12.7	0.44999999	NO					
120	OIL		MINOR	799.12	4.403	3	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
121	CONDENSATE		MINOR	599.34003	1	45	NO					
122	GAS		MINOR		4.761	0.013	NO					
123	GAS		MINOR		0.75	14	NO					
124	GAS		SIGNIFICANT		0.862	160	NO					
125	NON-PROCESS	DIESEL	MINOR	849.065	1	20.689659	NO					
126	GAS		MINOR		3.5	30	NO					
127	NON-PROCESS	DIESEL	MINOR	799.12	4	17	NO					
128	GAS		MINOR		3.547	20	NO					
129	OIL		SIGNIFICANT	840	11.5	14	NO					
130	GAS		SIGNIFICANT		2.162	140	NO					
131	GAS		SIGNIFICANT		3.629	23	NO					
132	GAS		SIGNIFICANT		17.189	0.25	NO					
133	OIL		MINOR	899.01001	1	5	NO					
134	GAS		MINOR		0.5	35	NO					
135	GAS		SIGNIFICANT		7.117	2.3	NO					
136	GAS		MINOR		0.221	29	NO					
137	OIL		MINOR	899	4	4.9000001	NO					
138	GAS		MINOR		0.1	90	NO					
139	NON-PROCESS	LUB OIL	MINOR	799.12	5.178	4.2758622	YES	DELAYED	1			2
140	NON-PROCESS	GLYCOL	MINOR	799.12	0.04	3.5	NO					
141	GAS		SIGNIFICANT		0.85	103.4483	NO					
142	NON-PROCESS	LUB OIL	SIGNIFICANT	799.12	4	4	NO					
143	GAS		MINOR		0.781	0.152	NO					
144	GAS		MINOR		0.1	66.586998	NO					
145	GAS		SIGNIFICANT		6.4	83.987	NO					
146	GAS		MAJOR		9	168	NO					
147	OIL		MINOR	899.01001	2	1.39	NO					
148	GAS		SIGNIFICANT		3.999	39	NO					
149	NON-PROCESS	LUB OIL	MINOR	799.12	N/A	3	YES	DELAYED		1		
150	GAS		SIGNIFICANT		5.791	27.59	YES	IMMEDIATE	1			
151	GAS		MAJOR		10.6	40	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
152	NON-PROCESS	METHANOL	SIGNIFICANT	799.12	2.781	133.987	NO					
153	NON-PROCESS	DIESEL	MINOR	799.12	1.017	3	NO					
154	GAS		SIGNIFICANT		14.301	1.00E-02	NO					
155	GAS		SIGNIFICANT		3.27	25	NO					
156	GAS		MINOR		20	6.70E-02	NO					
157	OIL		MINOR	830	1.559	22	NO					
158	OIL		MINOR	799.12	0.396	1.5	NO					
159	OIL		MINOR	845.90002	2.048	7.5	NO					
160	CONDENSATE		SIGNIFICANT	750	3.69	18	NO					
161	GAS		SIGNIFICANT		1.18	9	NO					
162	GAS		SIGNIFICANT		1.649	36	NO					
163	CONDENSATE		SIGNIFICANT	699.22998	5	41.379311	NO					
164	OIL		MINOR	0.83999997	1.3	10.5	NO					
165	CONDENSATE		MINOR	699.22998	5.1	41.379311	NO					
166	GAS		SIGNIFICANT		3.844	24	NO					
167	GAS		SIGNIFICANT		1.957	83.987	NO					
168	CONDENSATE		MINOR	799.12	0.585	18.965521	NO					
169	GAS		MINOR		0.348	10.5	NO					
170	OIL		SIGNIFICANT	799.12	11.011	0.60000002	NO					
171	GAS		SIGNIFICANT		6.35	17	NO					
172	GAS		MINOR		0.011	0.1	NO					
173	GAS		MINOR		0.351	160	NO					
174	GAS		MINOR		1.5	7	NO					
175	GAS		SIGNIFICANT		3.924	10	NO					
176	OIL		SIGNIFICANT	810	5.5	4.5	NO					
177	OIL		MINOR	860	5.871	29	NO					
178	GAS		SIGNIFICANT		10	20	NO					
179	GAS		SIGNIFICANT		3	219.0345	NO					
180	GAS		SIGNIFICANT		0.865	121	NO					
181	NON-PROCESS	DIESEL	MINOR	799.12	2	10	YES	IMMEDIATE	1			
182	GAS		SIGNIFICANT		3.223	10.5	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
183	CONDENSATE		MINOR	749.17999	0.846	160	NO					
184	GAS		SIGNIFICANT		6.19	2.987	NO					
185	GAS		SIGNIFICANT		0.5	60	NO					
186	GAS		MINOR		0.05	20.700001	NO					
187	GAS		MINOR		1	160	NO					
188	GAS		SIGNIFICANT		1.59	112	NO					
189	GAS		MINOR		6.245	0.18000001	NO					
190	OIL		MINOR	0.79000002	1	3.448276	NO					
191	GAS		MINOR		0.5	125	NO					
192	GAS		MINOR		1.3	180	NO					
193	CONDENSATE		MINOR	749.17999	0.324	63	NO					
194	GAS		MINOR		0.3	140	NO					
195	GAS		MINOR		0.3	72	NO					
196	GAS		MINOR		0.75	72.43	NO					
197	OIL		MINOR	0.89999998	1	0.60000002	NO					
198	GAS		SIGNIFICANT		16.5	0.48699999	NO					
199	NON-PROCESS	LUB OIL	MINOR	799.12	2.813	0.02	YES	IMMEDIATE	1			
200	NON-PROCESS	DIESEL	MINOR	799.12	3.875	5	YES	IMMEDIATE	1			
201	NON-PROCESS	HYDRAULIC OIL	MINOR	700	0.437	137.931	YES	IMMEDIATE	1			
202	OIL		MINOR	0.81999999	2.38	1	NO					
203	GAS		SIGNIFICANT		4.36	11.5	NO					
204	GAS		MINOR		0.1	40	NO					
205	NON-PROCESS	LUB OIL	MINOR	800	1	1	YES	IMMEDIATE	1			
206	OIL		MINOR	829.08698	0.663	1	NO					
207	GAS		MINOR		1	13	NO					
208	GAS		MINOR		2.336	1.7	YES	IMMEDIATE			1	
209	GAS		SIGNIFICANT		1.574	162.069	NO					
210	GAS		MINOR		0.6	24	NO					
211	NON-PROCESS	METHANOL	SIGNIFICANT	799.12	1.792	108.987	NO					
212	GAS		SIGNIFICANT		3	49	NO					
213	GAS		MINOR		0.5	170	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
214	OIL	DIESEL	MINOR	799.12	10.923	0.2068966	NO					
215	GAS		MINOR		0.5	102.069	NO					
216	NON-PROCESS		MAJOR	790	15.414	1.5	NO					
217	NON-PROCESS		MINOR	799.12	1	45	NO					
218	GAS		MINOR		0.1	35	NO					
219	GAS		MINOR		0.5	7.9000001	NO					
220	OIL		MINOR	790	0.5	35	NO					
221	GAS		MINOR		0.247	101.7241	NO					
222	GAS		MAJOR		12.7	70	NO					
223	GAS		SIGNIFICANT		1	341	NO					
224	GAS		SIGNIFICANT		15	42	NO					
225	GAS		SIGNIFICANT		0.656	125	NO					
226	GAS		MINOR		1.084	50	NO					
227	OIL		SIGNIFICANT	799.12	4.988	0.86206901	NO					
228	OIL		MINOR	799.12	2.858	7.5	NO					
229	GAS		MINOR		1	42	NO					
230	GAS		SIGNIFICANT		2.6	112	NO					
231	GAS		MINOR		0.1	2	NO					
232	GAS		SIGNIFICANT		1.225	72	NO					
233	CONDENSATE		MINOR	515	0.292	2	NO					
234	GAS		MINOR		0.5	45	NO					
235	GAS		SIGNIFICANT		3.377	112	NO					
236	GAS		MINOR		0.1	0	NO					
237	GAS		SIGNIFICANT		1.746	65	NO					
238	GAS		MINOR		0.5	291.72421	NO					
239	GAS		SIGNIFICANT		5.4	78	NO					
240	GAS		MINOR		1	49.5	NO					
241	NON-PROCESS	HYDRAULIC OIL	MINOR	799.12	4	168	NO					
242	OIL		MINOR	841	8	10	NO					
243	2-PHASE		MINOR	799.12	0.02	11	NO					
244	GAS		SIGNIFICANT		5.4	8	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
245	NON-PROCESS	HEAT TRANSFER OIL	MINOR	869.03998	0.1	8.5	YES	DELAYED	1			
246	OIL		MINOR	808	1.212	41.379311	NO					
247	GAS		MINOR		0.267	6.8965521	NO					
248	GAS		MINOR		0.292	70	NO					
249	GAS		MINOR		0.2	181	NO					
250	GAS		SIGNIFICANT		1.9	150	NO					
251	NON-PROCESS	LUB OIL	MINOR	869.04303	2.298	5	NO					
252	GAS		SIGNIFICANT		1.304	40	NO					
253	GAS		MINOR		3	1.103448	NO					
254	OIL		MINOR	950	1.5	5.3000002	NO					
255	GAS		SIGNIFICANT		7	28	NO					
256	GAS		MINOR		0.1	5.931035	NO					
257	OIL		SIGNIFICANT	941	8	10	NO					
258	GAS		SIGNIFICANT		3.43	16	NO					
259	2-PHASE		SIGNIFICANT	799.12	7.548	7.5	NO					
260	NON-PROCESS	LUB OIL	MINOR	883.02002	11.39	5.6100001	NO					
261	OIL		MINOR	790	1	25	NO					
262	GAS		MINOR		0.1	17.5	NO					
263	GAS		MINOR		0.04	20	NO					
264	OIL		MINOR	948.95502	3	10.5	NO					
265	GAS		MINOR		0.676	66	NO					

Table A.10. - Analysis of offshore data from 2004-2005

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1								0	0
2	1.360494577							0	0
3	80.04403633	0.000248	0.01843	3.92414E-05	1.077098264	0.014600495	0.001740715	1	0
4	35.79678129	0.008	0.017	0.000773981	16.84554414	0.220193331	0.026252118	1	0
5	62.65397244							1	0
6	21.50931432	0.008	0.017	0.001343905	10.12203027	0.363810421	0.043374585	1	0
7	26.97736538	0.0232	0.024	0.005010568	26.07811986	1.204916501	0.143653809	1	0
8	172.6058285	0.00714	0.03	0.002103387	41.08018719	0.546910437	0.065204325	1	0
9	45.63212158	0.008	0.017	0.00026208	21.47393957	0.082192983	0.009799297	1	0
10	228.1624434	0.00714	0.03	0.000601135	54.30266152	0.174954299	0.020858584	1	1
11	1.443014386	0.0232	0.024	0.00143686	1.394913907	0.38664028	0.04609643	1	1
12	6.63139956	0.008	0.017	0.002007521	3.120658616	0.524180168	0.062494354	1	0
13	56.92403458	0.05	0.024	0.018940933	118.5917387	4.041057666	0.481787183	1	0
14	31.14025299	0.008	0.017	0.000498304	14.6542367	0.147495941	0.017584915	1	0
15	168.4604632	5.44E-04	0.0226	0.000114632	4.054977521	0.038728127	0.004617285	1	0
16	32.45487098	0.00714	0.03	0.00030577	7.724259294	0.094573566	0.011275348	1	1
17								0	0
18	48.67474468							1	0
19	40.02201817	0.0232	0.024	0.002280945	38.68795089	0.588768197	0.070194735	1	0
20								0	0
21								0	0
22	12.49390095	0.008	0.017	0.002433548	5.879482801	0.624508287	0.074455777	1	0
23	39.29207255	0.00714	0.03	0.00159248	9.351513268	0.424567789	0.050618263	1	0
24	25.31214679	0.008	0.017	0.000709512	11.91159849	0.203438508	0.024254558	1	0
25	30.07531195	0.0232	0.024	0.003414528	29.07280155	0.849944859	0.101333011	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
26								0	0
27	16.57069005	0.000248	0.01843	2.8153E-05	0.222980528	0.010792622	0.001286729	1	0
28	219.2096215	0.00714	0.03	0.001105516	52.17188991	0.304581704	0.036313157	1	0
29	1.54264729	0.000248	0.01843		0.020758357			0	1
30	30.07531195	0.0232	0.024	0.005736206	29.07280155	1.3627252	0.162468242	1	0
31								0	1
32	27.80192187	0.008	0.017	0.000638115	13.08325735	0.184721627	0.022023074	1	0
33	40.02201817	0.008	0.017	0.000516642	18.8338909	0.152427166	0.01817283	1	0
34								0	0
35								0	0
36	195.9591827							0	1
37	85.43755762	0.008	0.017	0.001095452	40.20590947	0.302057713	0.036012239	1	0
38								0	0
39	1.424523883	0.008	0.017	0.00356957	0.67036418	0.884993877	0.105511661	1	0
40								0	0
41								0	0
42								0	0
43	17.89839064	0.0232	0.024	0.005694211	17.30177762	1.35364368	0.161385516	1	0
44	4.982534746	0.00714	0.03	0.001277292	1.18584327	0.347363241	0.041413702	1	1
45	116.6832313							1	0
46	62.00205167							1	0
47								0	0
48								0	0
49	5.55311248	0.008	0.017	0.002125118	2.613229402	0.552049859	0.065817063	1	0
50	93.47892397	0.008	0.017	0.002374978	43.99008187	0.610815374	0.072823266	1	0
51	40.02201817	0.0232	0.024	0.009854286	38.68795089	2.229763077	0.265839134	1	0
52								0	0
53								0	0
54								0	0
55	12.6560734	5.44E-04	0.0226	0.000138711	0.304641767	0.046065973	0.005492125	1	0
56								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
57								0	0
58								0	0
59								0	0
60								0	0
61								0	0
62	45.01995768	0.008	0.017	0.001497348	21.18586244	0.401424278	0.047859023	1	0
63	19.76546569	0.008	0.017	0.002955258	9.301395618	0.745249414	0.088850901	1	0
64								0	0
65	12.6560734	0.008	0.017	0.002142785	5.955799245	0.556224701	0.0663148	1	0
66								0	0
67								0	0
68	7.263877832	0.0232	0.024	0.007025388	7.021748571	1.638814545	0.195384453	1	0
69	75.89466384	0.000248	0.01843	4.12344E-05	1.021262975	0.015273775	0.001820986	1	0
70	17.16324264	0.00714	0.03	0.001152868	4.084851749	0.31643108	0.037725876	1	1
71	63.64458273	0.008	0.017	0.000927103	29.95039187	0.25950533	0.030939015	1	0
72	55.73151867	0.000248	0.01843	1.09252E-05	0.749941217	0.004560682	0.000543738	1	0
73								0	0
74	17.89015392	0.008	0.017	0.004039438	8.418895961	0.990402911	0.118078847	1	0
75								0	0
76	42.76409219	0.008	0.017	0.001203984	20.12427868	0.329173317	0.039245044	1	0
77								0	0
78								0	0
79								0	0
80								0	0
81								0	0
82	1.002510423	0.008	0.017	0.001793903	0.471769611	0.473169726	0.056412734	1	0
83								0	0
84								0	0
85								0	0
86								0	0
87								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
88	35.78286843	0.008	0.017	0.003128712	16.83899691	0.784950816	0.093584223	1	0
89								0	0
90								0	0
91	1.280204836	0.000248	0.01843	0.000148768	0.017226847	0.049095738	0.005853343	1	0
92	32.780603	0.008	0.017	0.000938765	15.42616612	0.262474211	0.031292974	1	0
93								0	0
94	36.68078467	0.008	0.017	0.000932439	17.26154573	0.26086416	0.031101018	1	0
95								0	0
96								0	0
97	61.72133998	0.008	0.017	0.000955992	29.04533646	0.266853578	0.031815095	1	0
98								0	0
99	24.70212605	0.008	0.017	0.002136486	11.62452991	0.554736696	0.066137396	1	0
100								0	0
101								0	0
102								0	0
103	9.803352462	0.008	0.017	0.001525614	4.613342335	0.408314144	0.048680454	1	0
104	98.03352298	0.008	0.017	0.001318668	46.13342258	0.357588105	0.042632741	1	0
105								0	0
106								0	0
107								0	0
108	55.19879636	0.008	0.017	0.000453217	25.97590417	0.135300248	0.016130907	1	0
109	67.21344403	0.00714	0.03	0.001430443	15.99679968	0.385068607	0.04590905	1	0
110								0	0
111								0	0
112								0	0
113								0	0
114	232.0059242	0.00714	0.03	0.001119865	55.21740997	0.308177306	0.036741836	1	0
115								0	0
116								0	0
117	26.96252374	0.0232	0.024	0.00468617	26.06377295	1.133715928	0.13516506	1	1
118								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
119								0	0
120	21.92096215	0.008	0.017	0.001956567	10.31574689	0.512059075	0.06104924	1	0
121	98.03352053	0.000248	0.01843	2.60646E-05	1.319170542	0.010061581	0.001199572	1	0
122								0	0
123								0	0
124								0	0
125	55.84845739	0.0232	0.024	0.0033118	53.98684214	0.826643235	0.09855492	1	0
126								0	0
127	52.18232742	0.0232	0.024	0.006425835	50.4429165	1.511039248	0.180150694	1	0
128								0	0
129	46.18802154	0.008	0.017	0.003241925	21.73553955	0.810756702	0.096660879	1	0
130								0	0
131								0	0
132								0	0
133	26.6813453	0.008	0.017	0.000989001	12.5559272	0.275225592	0.032813232	1	0
134								0	0
135								0	0
136								0	0
137	26.41333159	0.008	0.017	0.001977991	12.4298031	0.51715879	0.061657244	1	0
138								0	0
139	26.17042859	0.00714	0.03	0.002515625	6.228562004	0.643646693	0.076737516	1	1
140	23.67734526	0.02	0.045	0.000758529	10.52326456	0.216189478	0.025774767	1	0
141								0	0
142	25.31214679	0.00714	0.03	0.002211031	6.024290937	0.572322879	0.068234074	1	0
143								0	0
144								0	0
145								0	0
146								0	0
147	14.06792749	0.008	0.017	0.001398659	6.620201173	0.377274509	0.044979814	1	0
148								0	0
149	21.92096215	0.00714	0.03		5.217188991			0	1

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
150								0	1
151								0	0
152	146.4975347	5.44E-04	0.0226	0.000121916	3.52631234	0.040961331	0.004883534	1	0
153	21.92096215	0.0232	0.024	0.003240112	21.19026341	0.810344115	0.09661169	1	0
154								0	0
155								0	0
156								0	0
157	58.24749852	0.008	0.017	0.001186524	27.41058754	0.324826513	0.038726805	1	0
158	15.50046098	0.008	0.017	0.00058677	7.294334581	0.171145595	0.020404498	1	0
159	33.68806752	0.008	0.017	0.0013729	15.85320825	0.370946472	0.044225366	1	0
160	55.42562584	0.000248	0.01843	5.6009E-05	0.745825025	0.02018249	0.002406218	1	0
161								0	0
162								0	0
163	87.0335287	0.000248	0.01843	6.2952E-05	1.171151119	0.022447001	0.0026762	1	0
164	1264.911087	0.008	0.017	3.44688E-05	595.2522761	0.012975295	0.001546954	1	0
165	87.0335287	0.000248	0.01843	6.35784E-05	1.171151119	0.022650167	0.002700422	1	0
166								0	0
167								0	0
168	55.1164673	0.000248	0.01843	2.30196E-05	0.741664888	0.008986059	0.001071345	1	0
169								0	0
170	9.803352462	0.008	0.017	0.003094096	4.613342335	0.777043966	0.092641544	1	0
171								0	0
172								0	0
173								0	0
174								0	0
175								0	0
176	26.66666667	0.008	0.017	0.002201599	12.54901961	0.570100816	0.067969153	1	0
177	65.69839473	0.008	0.017	0.002343795	30.91689164	0.603513163	0.071952675	1	0
178								0	0
179								0	0
180								0	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
181	40.02201817	0.0232	0.024	0.004543752	38.68795089	1.102318502	0.131421764	1	1
182								0	0
183	165.3376999	0.000248	0.01843	2.68036E-05	2.224837198	0.010320841	0.001230482	1	0
184								0	0
185								0	0
186								0	0
187								0	0
188								0	0
189								0	0
190	747.4677224	0.008	0.017	2.93176E-05	351.7495164	0.01119815	0.001335078	1	0
191								0	0
192								0	0
193	103.7485833	0.000248	0.01843	1.65875E-05	1.396074262	0.006668982	0.000795096	1	0
194								0	0
195								0	0
196								0	0
197	292.1187055	0.008	0.017	3.12922E-05	137.4676261	0.011882458	0.001416663	1	0
198								0	0
199	1.789839064	0.00714	0.03	0.001854171	0.425981697	0.487613858	0.058134807	1	1
200	28.29984044	0.0232	0.024	0.006324635	27.35651243	1.489368196	0.177567005	1	1
201	158.8133136	0.00714	0.03	0.000683988	37.79756863	0.196767792	0.023459255	1	1
202	395.0918411	0.008	0.017	4.60797E-05	185.9255723	0.016898718	0.002014717	1	0
203								0	0
204								0	0
205	12.64911064	0.00714	0.03	0.001106124	3.010488332	0.304734269	0.036331346	1	1
206	12.42524433	0.008	0.017	0.000773341	5.8471738	0.220027849	0.026232389	1	0
207								0	0
208								0	1
209								0	0
210								0	0
211	132.1254057	5.44E-04	0.0226	9.78652E-05	3.180363748	0.033537555	0.003998449	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
212								0	0
213								0	0
214	5.75672736	0.008	0.017	0.003081707	2.70904817	0.774212172	0.092303929	1	0
215								0	0
216	15.58967526	0.0232	0.024	0.012541943	15.07001942	2.776973925	0.331079276	1	0
217	84.89952133	0.0232	0.024	0.003212918	82.06953728	0.80415256	0.095873514	1	0
218								0	0
219								0	0
220	75.30528584	0.008	0.017	0.000655561	35.43778157	0.189311778	0.022570326	1	0
221								0	0
222								0	0
223								0	0
224								0	0
225								0	0
226								0	0
227	11.75086945	0.008	0.017	0.002082494	5.529820918	0.541964634	0.064614672	1	0
228	34.66008444	0.008	0.017	0.001576346	16.31062797	0.420651776	0.050151384	1	0
229								0	0
230								0	0
231								0	0
232								0	0
233	22.29545646	0.000248	0.01843	1.3056E-05	0.300014824	0.005363476	0.00063945	1	0
234								0	0
235								0	0
236								0	0
237								0	0
238								0	0
239								0	0
240								0	0
241	164.0414599	0.00714	0.03	0.002211031	39.04186745	0.572322879	0.068234074	1	0
242	39.01278793	0.008	0.017	0.002705562	18.35895902	0.687723837	0.081992527	1	0

NO.	Exit Velocity (ms ⁻¹)	Viscosity (Kg m ⁻¹ s ⁻¹)	Surface tension (Nm ⁻¹)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
243	41.97544677							1	0
244								0	0
245	35.38299324	0.00714	0.03	0.000364568	8.42115239	0.110988617	0.0132324	1	1
246	80.96380905	0.008	0.017	0.001032218	38.10061602	0.286148726	0.034115521	1	0
247								0	0
248								0	0
249								0	0
250								0	0
251	27.13746939	0.00714	0.03	0.00174765	6.458717715	0.462054703	0.055087567	1	0
252								0	0
253								0	0
254	26.72274855	0.008	0.017	0.001245151	12.57541108	0.339399907	0.040464289	1	0
255								0	0
256								0	0
257	36.88163564	0.008	0.017	0.002861899	17.35606383	0.723794332	0.086292961	1	0
258								0	0
259	34.66008444							1	0
260	28.51682328	0.00714	0.03	0.003921985	6.78700394	0.964162522	0.114950388	1	0
261	63.64458273	0.008	0.017	0.000927103	29.95039187	0.25950533	0.030939015	1	0
262								0	0
263								0	0
264	37.63369151	0.008	0.017	0.00175994	17.70997247	0.465010636	0.055439982	1	0
265								0	0

Table A.11. - Offshore data from 2005-2006

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
1	GAS	FUEL OIL	SIGNIFICANT		10	13.8	NO					
2	OIL		MINOR	849.06	10.46	0.1	NO					
3	OIL		MINOR	840	3	30	NO					
4	GAS		SIGNIFICANT		1.21	124	NO					
5	GAS		MINOR		0.5	3.5	NO					
6	GAS		MINOR		0.863	56	NO					
7	GAS		MINOR		0.551	120	NO					
8	2-PHASE		MINOR	839.07599	22.707	0.013	NO					
9	GAS		SIGNIFICANT		43.87	0.324	NO					
10	NON-PROCESS		MINOR	899	2.179	1	NO					
11	GAS		MINOR		0.2	22	NO					
12	GAS		MINOR		0.211	74	NO					
13	GAS		MINOR		0.321	60	NO					
14	OIL		MINOR	948.90002	9.602	8	NO					
15	CONDENSATE		MINOR	599.34003	9.845	0.013	NO					
16	GAS		SIGNIFICANT		1	163	NO					
17	GAS		SIGNIFICANT		11	6.8965521	NO					
18	OIL		SIGNIFICANT	915.29211	16.567	0.013	NO					
19	CONDENSATE		SIGNIFICANT	599.34003	3.538	60	NO					
20	2-PHASE		MINOR	799.12	18.324	0.013	NO					
21	CONDENSATE		MINOR	599.34003	5	10	NO					
22	OIL		MINOR	839.07599	1.849	4.83E-02	NO					
23	OIL		MINOR	859.05402	3	7	NO					
24	GAS		MINOR		0.151	140	NO					
25	2-PHASE		SIGNIFICANT	799.12	1	17	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
26	OIL	LUB OIL	MINOR	790	1	12	NO	IMMEDIATE	1			
27	GAS		MINOR		0.2	70	NO					
28	GAS		MINOR		0.1	128	NO					
29	GAS		MINOR		0.311	70	NO					
30	OIL		MINOR	834	3	18	NO					
31	GAS		MINOR		0.745	106.89	NO					
32	GAS		MINOR		1.37	5.8800001	NO					
33	NON-PROCESS		MINOR	849.065	0.8	2.068965	YES					
34	GAS		SIGNIFICANT		3.3	10	NO					
35	OIL		MINOR	948.95502	44.5	0.68965518	NO					
36	OIL	DIESEL	SIGNIFICANT	839.06	8.398	15	NO	DELAYED				1
37	GAS		MINOR		0.1	20	NO					
38	OIL		MINOR	849.065	8	1.39	NO					
39	OIL		MINOR	799.12	1.074	15	NO					
40	OIL		MINOR	700	0.631	6.9000001	NO					
41	NON-PROCESS		SIGNIFICANT	779.14203	25.738	0.013	NO					
42	CONDENSATE		MINOR	670	>100	0.1	NO					
43	GAS		SIGNIFICANT		4	6.9000001	NO					
44	OIL		MINOR	998.90002	5	8.2758617	NO					
45	2-PHASE		MINOR	843.07001	0.056	40	NO					
46	NON-PROCESS	HEAT TRANSFER OIL	MINOR	799.12	0.5	6.21	YES	DELAYED				
47	GAS		MAJOR		45.7	8.00E-02	NO					
48	GAS		MINOR		0.483	0	NO					
49	NON-PROCESS	DIESEL	MINOR	849.065	10	7	NO					
50	GAS		MINOR		1	9.8599997	NO					
51	OIL		MINOR	915.29211	1	4	NO					
52	2-PHASE		SIGNIFICANT	810	1	20	NO					
53	GAS		MAJOR		1.5	221	NO					
54	OIL		MINOR	801.59998	2.551	30	NO					
55	OIL		MINOR	790	1	25	NO					
56	CONDENSATE		MINOR	599.34003	0.1	30	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
57	OIL	LUB OIL	MINOR	799.12	0.36	8.2758617	NO	IMMEDIATE	1			
58	NON-PROCESS		MINOR	886.02002	2	2.3	YES					
59	OIL		MINOR	790	1	40	NO					
60	GAS		SIGNIFICANT		1.3	100.0207	NO					
61	GAS		MAJOR		83.7	3.5	NO					
62	GAS		SIGNIFICANT		1	32	NO					
63	GAS		MINOR		0.853	29	NO					
64	GAS		MINOR		0.5	42	NO					
65	CONDENSATE		MINOR	855	1.5	24.987	NO					
66	CONDENSATE		SIGNIFICANT	749.17499	3	61	NO					
67	NON-PROCESS		MINOR	829.09998	2	16	YES		1			
68	OIL		SIGNIFICANT	878.93213	10	12	NO					
69	2-PHASE		SIGNIFICANT	799.12	0.661	100	NO					
70	OIL		MINOR	750	1	19	NO					
71	GAS		MINOR		10	1	NO					
72	GAS		MINOR		1	40	NO					
73	GAS		MINOR		0.1	28.98621	NO					
74	OIL		MINOR	799.12	1	2.206897	NO					
75	GAS		SIGNIFICANT		3	78	NO					
76	GAS		SIGNIFICANT		2.506	173.987	NO					
77	GAS		SIGNIFICANT		14.064	123	NO					
78	GAS		SIGNIFICANT		0.755	27	NO					
79	OIL		MINOR	799.12	2	2.758621	NO					
80	GAS		MINOR		2.505	10	NO					
81	GAS		SIGNIFICANT		2	60	NO					
82	OIL		SIGNIFICANT	815	6	17	NO					
83	OIL		MINOR	824	1	4.5	NO					
84	2-PHASE		MAJOR	990	11	4.5	NO					
85	GAS		SIGNIFICANT		2	60	NO					
86	GAS		MINOR		1	7.5	NO					
87	NON-PROCESS		MINOR	799.12	2.764	1	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
88	GAS		MINOR		1.3	12	NO					
89	CONDENSATE		MINOR	899.01001	0.274	40	NO					
90	GAS		MINOR		1	28	NO					
91	GAS		MINOR		0.957	2	NO					
92	GAS		SIGNIFICANT		1.02	16	NO					
93	GAS		SIGNIFICANT		2.209	72.413803	NO					
94	GAS		MINOR		0.319	43	NO					
95	GAS		SIGNIFICANT		1.37	18.299999	NO					
96	GAS		SIGNIFICANT		1	130	NO					
97	OIL		MINOR	839.07599	1	5.8827591	NO					
98	GAS		MINOR		4.82	5	NO					
99	2-PHASE		SIGNIFICANT	979.82098	2	10	NO					
100	OIL		MINOR	799.12	1.41	14	NO					
101	GAS		SIGNIFICANT		19.05	4.482759	NO					
102	GAS		SIGNIFICANT		4.723	4	NO					
103	OIL		MINOR	819.09802	42.554	1	NO					
104	GAS		SIGNIFICANT		4.7	23.787001	NO					
105	NON-PROCESS	DIESEL	MINOR	840	2.54	7	NO					
106	NON-PROCESS	LUB OIL	SIGNIFICANT	859.05402	1.707	10.9	YES	IMMEDIATE	1			2
107	OIL		MINOR	839.07599	1.5	27.58621	NO					
108	GAS		MINOR		0.585	16.5	NO					
109	GAS		MINOR		0.1	19.5	NO					
110	GAS		MINOR		0.5	35	NO					
111	CONDENSATE		MINOR	596.34332	0.2	8	NO					
112	2-PHASE		MINOR	918.98798	1	16	NO					
113	GAS		SIGNIFICANT		3.41	20	NO					
114	OIL		SIGNIFICANT	799.12	4.303	4	NO					
115	NON-PROCESS	HYDRAULIC OIL	MINOR	1000	5	70	NO					
116	NON-PROCESS	DIESEL	MINOR	819.09802	2.718	0.13	NO					
117	GAS		MINOR		0.1	130	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
118	GAS	DIESEL	SIGNIFICANT	599.34003	8.333	36	NO					
119	CONDENSATE		MINOR		1	1	NO					
120	GAS		MINOR		1.1	6	NO					
121	GAS		MINOR		30.743	0.5	NO					
122	GAS		MINOR		1.681	20	NO					
123	OIL		MINOR	799.12	2	32	NO					
124	NON-PROCESS		MINOR	799.12	2.364	1	NO					
125	GAS		SIGNIFICANT	971	3	75	NO					
126	GAS		MINOR		0.5	83	NO					
127	CONDENSATE		MINOR		1	19.5	NO					
128	GAS		MINOR		0.5	65	NO					
129	OIL		SIGNIFICANT		833.08258	20	NO					
130	2-PHASE		MINOR	919	0.3	71	NO					
131	GAS	FUEL OIL	MINOR	849.065	1	178	NO					
132	GAS		MINOR		1	1	NO					
133	GAS		MINOR		0.1	85	NO					
134	GAS		SIGNIFICANT		14.827	0.1	NO					
135	2-PHASE		SIGNIFICANT		3.51	0.1	NO					
136	GAS		MINOR	994.90442	0.138	65	NO					
137	NON-PROCESS		MINOR		6.35	2.758621	NO					
138	GAS		MINOR		1	0.077	NO					
139	2-PHASE		SIGNIFICANT		838	2.443	NO					
140	CONDENSATE		MINOR		866	6	NO					
141	GAS		SIGNIFICANT	810	11	1.5	NO					
142	OIL		MINOR		0.01	1	NO					
143	OIL		MINOR		830	1	NO					
144	GAS		MINOR		0.67	170	NO					
145	OIL		MINOR		917.40002	2	NO					
146	2-PHASE		SIGNIFICANT	799.12	64.8	0	NO					
147	GAS		SIGNIFICANT		2	15.86207	NO					
148	GAS		SIGNIFICANT		22.717	0.013	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
149	GAS		SIGNIFICANT		24	42	NO					
150	GAS		SIGNIFICANT		0.935	47	NO					
151	GAS		MINOR		N/A	0.013	YES	IMMEDIATE		1		
152	CONDENSATE		MINOR	650	19.05	-0.013	NO					
153	GAS		MINOR		1	82.275864	NO					
154	GAS		SIGNIFICANT		4.95	20	NO					
155	GAS		MINOR		0.7	3.487	NO					
156	CONDENSATE		MINOR	649.28497	1.318	0.2	NO					
157	GAS		MINOR		0.9	1.087	NO					
158	GAS		SIGNIFICANT		2.5	280	NO					
159	GAS		SIGNIFICANT		3.631	35	NO					
160	GAS		SIGNIFICANT		1	160	NO					
161	GAS		SIGNIFICANT		0.942	220	NO					
162	NON-PROCESS	LUB OIL	MINOR	799.12	1	78.206886	NO					
163	GAS		SIGNIFICANT		3	178	NO					
164	OIL		MINOR	834.08148	0.1	8	NO					
165	OIL		MINOR	799.12	1	8	NO					
166	OIL		MINOR	843.07159	0.026	100	NO					
167	NON-PROCESS	DIESEL	MINOR	870	2	10	YES	IMMEDIATE	1			
168	NON-PROCESS	DIESEL	MINOR	799.12	5	4.6999998	NO					
169	NON-PROCESS	DIESEL	MINOR	799.12	1	7	NO					
170	GAS		SIGNIFICANT		0.8	55	NO					
171	2-PHASE		SIGNIFICANT	799.12	0.319	21	NO					
172	NON-PROCESS	DIESEL	MINOR	899.01001	13.69	0	NO					
173	GAS		MINOR		0.1	140	NO					
174	GAS		SIGNIFICANT		3.407	6.1999998	NO					
175	GAS		MINOR		0.645	85	NO					

NO.	PROCESS	NON PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN TYPE	FLASH	EXPLOSION	JET	POOL
176	GAS	GLYCOL DIESEL 2-PHASE LUB OIL	SIGNIFICANT		9.33	5	NO	DELAYED	1			
177	OIL		MINOR	700	2.2	1.37931	NO					
178	NON-PROCESS		MINOR	849.06	3.5	0.2068966	NO					
179	NON-PROCESS		MINOR	807.10999	3.175	35	NO					
180	2-PHASE		MINOR	799.12	10	689.65521	NO					
181	GAS		MINOR		0.154	0.013	NO					
182	NON-PROCESS		MINOR	849.065	0.029	1.77	YES					
183	GAS		SIGNIFICANT		1.769	20	NO					
184	GAS		MINOR		2	7	NO					
185	GAS		SIGNIFICANT		0.367	124	NO					
186	GAS		SIGNIFICANT		25.5	1.8	NO	DELAYED	1	2	3	4
187	GAS		MINOR		0.541	204	NO					
188	OIL		MINOR	803.70001	2.332	7	NO					
189	GAS		MINOR		0.1	100	NO					
190	GAS		SIGNIFICANT		3	31.487	NO					
191	OIL		SIGNIFICANT	799.12	3.175	0.5	NO					
192	GAS		MAJOR		>100	93	YES					
193	GAS		MINOR		N/A	0.013	NO					
194	GAS		MINOR		0.5	25	NO					
195	GAS		MINOR		2.58	0.41999999	YES					
196	OIL		SIGNIFICANT	830.013	3.261	11.5	NO	IMMEDIATE	1			
197	OIL		MINOR	960	0.1	17	NO					
198	GAS		MINOR		0.258	20	NO					
199	GAS		MINOR		0.73	80	NO					

NO.	PROCESS	NON_PROCESS	SEVERITY	GRAVITY	HOLE DIAM	ACT PRESSURE	IGNITION	IGN_TYPE	FLASH	EXPLOSION	JET	POOL
200	GAS	DIESEL	MINOR	799.12	0.84	45	NO					
201	OIL		SIGNIFICANT		2.348	58	NO					
202	GAS		SIGNIFICANT		3	117	NO					
203	GAS		MINOR		1	0.345	NO					
204	GAS		SIGNIFICANT		3.438	70	NO					
205	GAS		SIGNIFICANT		5	178	NO					
206	OIL		MINOR	900	3.755	1.37931	NO					
207	NON-PROCESS		SIGNIFICANT	850	3	0.48699999	NO					
208	OIL		MINOR	830	1	15.2	NO					
209	CONDENSATE		MINOR	815	1.8	47	NO					
210	GAS		MINOR		1	29	NO					

Table A.12. - Analysis of offshore data from 2005-2006

NO.	Exit Velocity (ms-1)	Viscosity (Kg.m-1s-1)	Surface tension (Nm-1)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
1								0	0
2	3.882717509	0.008	0.017	0.020588774	1.827161181	4.356849639	0.519785011	0	0
3	67.61234038	0.008	0.017	0.038651402	31.81757194	7.728393134	0.922020092	1	0
4								0	0
5								0	0
6								0	0
7								0	0
8	1.408237853							1	0
9								0	0
10	11.93232679	0.05	0.024	0.230598205	24.85901415	39.26157455	4.684021629	1	0
11								0	0
12								0	0
13								0	0
14	32.85033104	0.008	0.017	0.020327054	15.45897931	4.306421851	0.513768827	1	0
15	1.666249447	0.000248	0.01843	0.000752046	0.022421588	0.214363741	0.025574226	0	0
16								0	0
17								0	0
18	1.348331875	0.008	0.017	0.015756644	0.634509118	3.415551344	0.407485348	0	0
19	113.1993589	0.000248	0.01843	0.001254508	1.523246935	0.341491319	0.040740921	1	0
20	1.443014386							1	0
21	46.21344477	0.000248	0.01843	0.001055279	0.621862957	0.291764957	0.03480842	1	0
22	2.713582178	0.008	0.017	0.049260229	1.276979848	9.636971369	1.149719104	1	0
23	32.2956305	0.008	0.017	0.03822035	15.19794376	7.649921265	0.912658167	1	0
24								0	0
25	52.18232742							1	0
26	44.09426037	0.008	0.017	0.069032242	20.75024017	13.10105065	1.562993978	1	0
27								0	0

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-ls-1)	Surface tension (Nm-1)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
28								0	0
29								0	0
30	52.56034559	0.008	0.017	0.038790187	24.73428028	7.7536417	0.925032321	1	0
31								0	0
32								0	0
33	17.66082907	0.00714	0.03	0.050017516	4.20327732	9.77169614	1.165792167	1	1
34								0	0
35	9.644909842	0.008	0.017	0.009441972	4.538781102	2.143265072	0.255697844	0	0
36	47.8359172	0.008	0.017	0.023114318	22.51101986	4.840615733	0.577499732	1	0
37								0	0
38	14.47577805	0.008	0.017	0.023542364	6.812130845	4.922122078	0.58722368	1	0
39	49.01676149	0.008	0.017	0.066230401	23.06671129	12.61627201	1.505158457	1	0
40	35.52061801	0.008	0.017	0.092321282	16.71558495	17.06842646	2.036313613	1	0
41	1.461397448	0.0232	0.024	0.033441569	1.4126842	6.774381872	0.808203735	0	0
42	4.370866918	0.000248	0.01843					0	0
43								0	0
44	32.56496278	0.008	0.017	0.027454878	15.32468837	5.661253213	0.675404204	1	0
45	77.92972795							1	0
46	31.53877239	0.00714	0.03	0.065214862	7.506227828	12.44010978	1.484141784	1	1
47								0	0
48								0	0
49	32.48504969	0.0232	0.024	0.051393938	31.4022147	10.01609989	1.194950255	1	0
50								0	0
51	23.65130568	0.008	0.017	0.064133607	11.1300262	12.25227625	1.461732689	1	0
52	56.21826951							1	0
53								0	0
54	69.21285488	0.008	0.017	0.042907326	32.57075524	8.49909025	1.013966531	1	0
55	63.64458273	0.008	0.017	0.069032242	29.95039187	13.10105065	1.562993978	1	0
56	80.04403433	0.000248	0.01843	0.007461951	1.077098237	1.730073207	0.206402836	1	0
57	36.4087356	0.008	0.017	0.114395325	17.13352263	20.74533031	2.474979086	1	0
58	18.22834062	0.00714	0.03	0.03096712	4.338345067	6.316675523	0.753598018	1	1

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-1s-1)	Surface tension (Nm-1)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
59	80.50473687	0.008	0.017	0.069032242	37.88458206	13.10105065	1.562993978	1	0
60								0	0
61								0	0
62								0	0
63								0	0
64								0	0
65	61.16162081	0.000248	0.01843	0.001613096	0.823010416	0.429279076	0.05121426	1	0
66	102.0888395	0.000248	0.01843	0.001218531	1.373740217	0.332567853	0.039676326	1	0
67	49.70058765	0.0232	0.024	0.116295769	48.0439014	21.05872071	2.512367484	1	1
68	41.80400947	0.008	0.017	0.020696069	19.67247505	4.377506222	0.522249402	1	0
69	126.560734							1	0
70	56.94441734	0.008	0.017	0.070849191	26.79737287	13.41447181	1.600386047	1	0
71								0	0
72								0	0
73								0	0
74	18.80139254	0.008	0.017	0.068637195	8.847714138	13.03280784	1.55485241	1	0
75								0	0
76								0	0
77								0	0
78								0	0
79	21.02059495	0.008	0.017	0.048533826	9.892044681	9.507565893	1.134280649	1	0
80								0	0
81								0	0
82	51.67144908	0.008	0.017	0.027746685	24.31597604	5.715982904	0.681933617	1	0
83	26.43915895	0.008	0.017	0.067593031	12.44195715	12.85226201	1.53331276	1	0
84	24.12090757							1	0
85								0	0
86								0	0
87	12.6560734	0.0232	0.024	0.100764451	12.23420428	18.48325719	2.205107091	1	0
88								0	0
89	75.46624076	0.000248	0.01843	0.003680709	1.015497977	0.9094241	0.108496977	1	0

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-1s-1)	Surface tension (Nm-1)	Ohnsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
90								0	0
91								0	0
92								0	0
93								0	0
94								0	0
95								0	0
96								0	0
97	29.95676206	0.008	0.017	0.066983044	14.09729979	12.74667355	1.520715745	1	0
98								0	0
99	36.14361751							1	0
100	47.35469051	0.008	0.017	0.057802946	22.28456024	11.14662256	1.329824944	1	0
101								0	0
102								0	0
103	12.50077812	0.008	0.017	0.010392676	5.882719114	2.338787432	0.279024238	0	0
104								0	0
105	32.65986324	0.0232	0.024	0.102524076	31.57120113	18.77674716	2.240121309	1	0
106	40.30027378	0.00714	0.03	0.034041649	9.59146516	6.884913003	0.821390425	1	1
107	64.87096476	0.008	0.017	0.054691426	30.52751283	10.59925499	1.264522379	1	0
108								0	0
109								0	0
110								0	0
111	41.43828747	0.000248	0.01843	0.005289637	0.557606907	1.264987791	0.150916774	1	0
112	47.2073977							1	0
113								0	0
114	25.31214679	0.008	0.017	0.033088254	11.91159849	6.709219948	0.800429726	1	0
115	94.65727653	0.00714	0.03	0.018435401	22.52843181	3.940149251	0.470071425	1	0
116	4.507219649	0.0232	0.024	0.100366713	4.356978994	18.4168542	2.197185018	1	0
117								0	0
118								0	0
119	14.6139744	0.000248	0.01843	0.002359676	0.196650334	0.606826419	0.072396181	1	0
120								0	0

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-1s-1)	Surface tension (Nm-1)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
121								0	0
122								0	0
123	71.59356257	0.008	0.017	0.048533826	33.69108827	9.507565893	1.134280649	1	0
124	12.6560734	0.0232	0.024	0.108956371	12.23420428	19.84580476	2.367663034	1	0
125								0	0
126								0	0
127	50.70055058	0.000248	0.01843	0.001853871	0.682242894	0.487215477	0.058126243	1	0
128								0	0
129	55.43396662	0.008	0.017	0.03881154	26.08657253	7.75752559	0.92549568	1	0
130	99.44350051							1	0
131								0	0
132								0	0
133								0	0
134								0	0
135	3.882706077							1	0
136								0	0
137	18.83910747	0.05	0.024	0.12840645	39.24814057	23.04532558	2.749375304	1	0
138								0	0
139	67.69297528							1	0
140	4.516329111	0.000248	0.01843	0.000801409	0.060773175	0.227130975	0.027097395	1	0
141								0	0
142	12.57078722	0.008	0.017	0.681746657	5.915664575	105.2848223	12.56078979	0	0
143	52.6868448	0.008	0.017	0.067348276	24.79380932	12.80990533	1.528259483	1	0
144								0	0
145	36.40721134	0.008	0.017	0.045297179	17.13280534	8.928809865	1.065233348	1	0
146	0							1	0
147								0	0
148								0	0
149								0	0
150								0	0
151								0	1

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-1s-1)	Surface tension (Nm-1)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
152		0.000248	0.01843	0.00051914		0.15299528	0.018252788	0	0
153								0	0
154								0	0
155								0	0
156	6.279170964	0.000248	0.01843	0.001974757	0.084494541	0.516043402	0.0615655	1	0
157								0	0
158								0	0
159								0	0
160								0	0
161								0	0
162	111.9235513	0.00714	0.03	0.046113871	26.6378052	9.075186628	1.082696528	1	0
163								0	0
164	35.03851884	0.008	0.017	0.212452227	16.48871475	36.43985117	4.347381708	1	0
165	35.79678129	0.008	0.017	0.068637195	16.84554414	13.03280784	1.55485241	1	0
166	123.2176034	0.008	0.017	0.414425648	57.98475455	66.93376458	7.985395507	0	0
167	38.35706412	0.0232	0.024	0.113529242	37.07849531	20.60235501	2.45792171	1	1
168	27.43771271	0.0232	0.024	0.074918895	26.52312229	14.11389761	1.683829607	1	0
169	33.48482278	0.0232	0.024	0.167523741	32.36866202	29.35474515	3.502107666	1	0
170								0	0
171	57.99741434							1	0
172	0	0.0232	0.024	0.04268727	0	8.459415283	1.009233191	0	0
173								0	0
174								0	0
175								0	0
176								0	0
177	15.88133136	0.008	0.017	0.04944304	7.473567698	9.669511274	1.153601211	1	0
178	5.584862318	0.02	0.045	0.054691587	2.48216103	10.59928334	1.26452576	1	0
179	74.50280869	0.0232	0.024	0.093550075	72.01938174	17.27503709	2.06096287	1	0
180	332.3647794							1	0
181								0	0
182	16.33507559	0.00714	0.03	0.262704865	3.887747991	44.20636536	5.273949755	0	1

NO.	Exit Velocity (ms-1)	Viscosity (Kg m-1s-1)	Surface tension (Nm-1)	Ohmsorge no.	Capillary no.	Atomisation	Second wind	Flammable Mist?	Ignited?
183								0	0
184								0	0
185								0	0
186								0	0
187								0	0
188	33.38927722	0.008	0.017	0.044818185	15.71260105	8.842848928	1.054977955	1	0
189								0	0
190								0	0
191	8.949195322	0.008	0.017	0.038520123	4.211386034	7.704502404	0.919169858	1	0
192								0	1
193								0	0
194								0	0
195								0	1
196	42.11254206	0.008	0.017	0.037294748	19.81766685	7.481147399	0.892522947	1	0
197	47.60952286	0.008	0.017	0.198029509	22.40448134	34.18165142	4.077971819	1	0
198								0	0
199								0	0
200								0	0
201	96.3857834	0.008	0.017	0.044793034	45.35801572	8.838332991	1.054439191	1	0
202								0	0
203								0	0
204								0	0
205								0	0
206	14.00601775	0.008	0.017	0.033376385	6.591067178	6.762364669	0.806770048	1	0
207	8.563671472	0.0232	0.024	0.093780442	8.278215756	17.31374402	2.065580721	1	0
208	48.41586915	0.008	0.017	0.067348276	22.78393842	12.80990533	1.528259483	1	0
209	85.91620972	0.000248	0.01843	0.001508252	1.156116116	0.403812839	0.048176063	1	0
210								0	0

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Flammable mists from accidental hydrocarbon releases offshore

The report investigates offshore hydrocarbon releases in an attempt to identify whether mists of hydrocarbon droplets were formed, and if these presented a flammability hazard. Scientific literature has been searched for the present state of knowledge of the physics of two-phase mist generation. An empirical correlation has been used to model the reported hydrocarbon releases for a five year period and estimate whether flammable mists could have been generated.

It was found that ninety-five percent of reported liquid releases (forty-five percent of total reported releases) could have formed flammable mists. It was also noted that there were thirty-five cases of high flash point diesel and machine oils igniting as flash fires in five years.

Having established that flammable mists are being generated, the state of computational modelling and its validity has been reviewed to identify whether industry is able to characterise this risk in order to enact measures to control it. This found that computer programs existed to model both mechanical and flashing mist generation although the ability of these programs to model subsequent dispersion and rainout was limited. Validation studies of jet breakup are continuing but are focused on characterisation of single component flashing releases, not mechanical breakup of multiple component mixtures.

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